CALIFORNIA STRAWBERRY COMMISSION

PEST MANAGEMENT EVALUATION
for

Strawberries in California

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An Evaluation of Soil-Borne Pest Management for Strawberries in California in the Absence of Methyl Bromide

PRINCIPAL INVESTIGATOR:
Frank Westerlund
California Strawberry Commission

CONTRACTOR ORGANIZATION:
California Strawberry Commission

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Pest Management Alliance Team Members:

Thomas Trout	USDA-Agricultural Research Service (Secondary Team Leader)
Husein Ajwa	USDA-ARS
John Duniway	UC Davis, Department of Plant Pathology
Albert Paulus	UC Riverside, Department of Plant Pathology
Colin Carter	UC Davis, Department of Agricultural Economics
Richard Molinar	UC Cooperative Extension
Howard Levinson	California Integrated Waste Management Board
Toula Thao	Hmong American Community
James Mueller	Dow AgroSciences
Jerry Krebs	Sundance Ag, Inc.

Pesticide Control Advisors:

Steve Nelson	Plant Sciences Inc.
Randy Malone	
William Harrison	Kurt Produce, Inc.
Gary Omori	
Lawrence London	

Technical Assistance:

Oleta Melnicoe	Technology Sciences Group Inc.
Arthur Lawyer	Technology Sciences Group Inc.
Stan VanVleck	Kahn, Soares & Conway

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California produces 80% of fresh market strawberries. These strawberries are grown on roughly 23,000 acres per year and have an estimated annual value of 580 million dollars. For most of this century, the strawberry industry has relied on both chemical treatments and cultural practices to treat soil borne diseases, insects and weeds so that these pests would not significantly impact the fruit yield and/or quality. One of the tools that the industry has heavily relied upon is methyl bromide, a broad-spectrum soil fumigant, applied in combination with chloropicrin.

Methyl bromide has properties that have been identified as being problematic to both the environment and public health and it will therefore be phased out by the year 2001. There are no broad-spectrum soil fumigant options currently available to the strawberry industry that are ready for widespread use and will fully replace the control provided by methyl bromide. The continued economic success of the strawberry industry in California will be based, in part, on the industry's ability to develop a pest management program that balances cultural and biological control practices with chemical treatment.

This document discusses the current pest management program used by the strawberry industry, including cultural practices, biological control and chemical treatments. It also discusses potential reduced risk pest management practices that may help the industry address the impending challenges from the loss of the industry's key pest control tool, methyl bromide.

CALIFORNIA STRAWBERRY COMMISSION

PEST MANAGEMENT EVALUATION
For

An Evaluation of Soil-Borne Pest Management for Strawberries in California in the Absence of Methyl Bromide

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I. INTRODUCTION:

California is first in strawberry production in the United States, producing 80% of fresh market strawberries. These strawberries are grown on roughly 24,000 acres per year and have an estimated annual value of approximately 580 million dollars. The continued economic success of the strawberry industry in California will be based, in part, on the industry's ability to develop a pest management program that balances cultural and biological control practices with chemical treatment.

For most of this century, the strawberry industry has relied on both chemical treatments and cultural practices to treat soil borne diseases, insects and weeds so that these pests would not significantly impact the fruit yield and/or quality. In recent decades, one of the tools that the industry has heavily relied upon is methyl bromide, a broad-spectrum soil fumigant, applied in combination with chloropicrin. The mixture of these two fumigants has proven highly effective due to the unique ability of methyl bromide to penetrate the soil and "find" adverse soil-borne pests as well as the higher fungal toxicity of chloropicrin. Pre-plant applications control many soil borne diseases, including most agronomically important diseases, prevents weed germination, and kills arthropods that may be present in the soil. In addition, methyl bromide is used as a pre-plant soil fumigant in both the nursery and the field as a means of protecting the strawberry stock from infection and infestation.

Though methyl bromide is an effective pest management tool that currently is crucial to the agronomic practices of California's strawberry industry, the compound has properties that have been identified as being problematic to both the environment and public health. Methyl bromide has been identified as having the potential to deplete the Earth's ozone layer, and has become highly regulated and is being phased-out. Domestic production of methyl bromide has been frozen at 1991 levels and the importation and production of methyl bromide will cease by the year 2001. There are no broad-

spectrum soil fumigant options currently available to the strawberry industry that are ready for widespread use and will fully replace the control provided by methyl bromide.

The use of methyl bromide as a key pest management tool has resulted in relative economic stability for the California strawberry industry for many years. With the impending loss of methyl bromide as a pest management tool, the strawberry industry faces the challenge of developing a sound, multi-faceted, reduced-risk approach to integrated pest management that will provide viable biological controls, cultural practices and chemical tools for disease, insect and weed control.

II. SUMMARY OF INFORMATION REGARDING PEST COMPLEXES:

Hectarage of production strawberries in California has increased by over 78% from 5,666 hectares in 1985 to 10,117 hectares in 1996. Strawberry production in California occurs primarily along the central and southern coast, with a small amount in inland areas. These areas can be divided into five different growing regions: Central Coast, Santa Maria Valley, Oxnard Plain, South Coast and the San Joaquin Valley. Although each of these regions has unique growing conditions (e.g.: weather, soil conditions), growers face many of the same pest problems.

The table entitled Pest Management Evaluation Guide (Appendix 1) summarizes the crucial pests impacting California's strawberry industry and the cultural, biological and chemical methods that are available for managing these pests. The relative efficacy and economic viability of these methods are summarized in the table and detailed in the following sections of this document. Appendix 2 encloses a copy of the 1996 Pest Management Survey Database for strawberries in California. This Database was developed jointly by the UC Statewide IPM Project and the Department of Pesticide Regulation.

DISEASES. Diseases are potentially serious economic problems in all strawberry growing areas within the state of California. The impact of the disease depends on regional weather and soil conditions, quality of planting materials, and cultural practices. Coastal areas and nurseries tend to have cool, damp conditions that are favorable for disease development. Plant diseases involve complex interactions of causal agents, host plant and environmental factors. The use of good cultural practices, certified transplants, and soil fumigation has allowed the strawberry grower to minimize the impact of plant diseases.

Diseases are generally identified by the part of the plant that is infected. The most agronomically important diseases are listed below. Complete descriptions of each disease are enclosed in Appendix 3. These descriptions are summaries of these pests and their management that have been developed by the UC Statewide Integrated Pest Management Project.

Fruit Disease:	Anthracnose
	Botrytis Fruit Rot (Gray Mold)
	Rhizopus Rot (Leak)
	Mucor Fruit Rot
	Leather Rot
	Powdery Mildew
Foliar/Crown Disease:	Angular Leaf Spot
	Anthracnose
	Common Leaf Spot
	Powdery Mildew
	Leather Rot
Root/Crown Disease:	Anthracnose
	Phytophthora Root and Crown Rot, including Red Stele Root Rot
	Verticillium Wilt
	Black Root Rot

The use of good cultural practices is critical in the management of disease. These practices include field selection, raised beds, the use of certified stock, use of resistant cultivars, use of drip irrigation, the removal and destruction of dead leaves and fruit from strawberry plants, the use of plastic mulches to prevent berry-soil contact, good sanitation methods during harvest, packing, transport and storage, and crop rotation with a non susceptible crop.

Research related to soil solarization and hot water treatments is underway. Solarization is a technique in which heat generated by solar radiation on clear plastic covered moist soil kills soil-borne pathogens, nematodes, and weed seeds in the upper 2 to 6 inches of the soil. The technique appears to have more potential in central valley growing areas where solar radiation is highest and

the relatively long crop-free period required for solarization is consistent with the region's cultural schedules. Solarization may also be useful in other inland locations, but along the coast clouds, fog, or wind prevent adequate solar heating of the soil. Because solarization generated heat only penetrates 2-6" deep, it may need to be combined with other control methods, such as fumigation of the deeper soil profile. The effectiveness of fumigants, such as methyl isothiocyanate (whether generated from the use of Vapam, or from crop residues), may be increased when used in combination with soil solarization.

Hot water dipping of bare-root strawberry plants in nurseries can reduce nematodes and some diseases. This method, however, cannot be used for transplants intended for fruit production in fields because plant vigor is reduced substantially by the hot water treatment.

Chemical treatment begins with a pre-plant fumigation of the soil with methyl bromide and chloropicrin to reduce the innoculum of potentially serious strawberry diseases. This pre-plant fumigation also significantly increases yields and quality by impacting plant pathogens of unknown identity. Virticillium wilt and Phytophthora root rot are usually not problems in fields that have been fumigated properly. Pre-plant fumigation plays an important role in managing anthracnose and common leaf spot. Fumigation, however, does not kill all pathogen populations, so they will increase to levels sufficient to cause damage if pre-plant soil treatment is not repeated on a regular basis. Fungicides, such as benomyl, iprodione and vinclozolin to control above ground diseases (e.g.: anthracnose, powdery mildew, botrytis fruit rot), must be applied before infection occurs or when the disease just begins to develop. Resistance problems are a major concern when it comes to fungicides, so applications of these types of products are made when conditions indicate that control action is needed. Different types of products are usually applied when repeat applications are needed, to avoid resistance development.

INSECTS AND MITES. A variety of insect and mite pests occur in California strawberries, some are beneficial predators or parasites of insect pests, but others are destructive and can cause yield decreases and/or fruit grade reductions. The importance of mite and insect pests depends on the location, harvest season, market destination of the crop, and whether strawberry plants are held over for a second year of production. Insects and mites usually are damaging when their feeding kills plants or reduces the supply of nutrients available for fruit production. In some cases fruit quality is reduced by diminished size, contamination, scarring, or growth distortion. Insects

identified as pests of concern for the strawberry industry in California are listed below. Complete descriptions of each of these pests are found in Appendix 4 which is comprised of summaries developed by the UC Statewide Integrated Pest Management Project.

Aphids
Beet Armyworm
Cabbage Looper
Corn Earworm
Cutworms
Cyclamen Mite
European Earwig
Garden Symphylan
Garden Tortrix
Lygus Bugs
Root Weevils
Saltmarsh Caterpillar
Twospotted Spider Mite
Western Flower Thrips
Whiteflies

Many insects and mites found in strawberry fields are beneficial predators or parasites that help suppress the pest populations. Predatory mites and parasitic wasps tend to attack only a single pest or a few types of pests, but can play an important role in keeping those pests under control. When pesticide applications are needed, products that are least harmful to the predatory insects are selected whenever possible.

Cultural practices are critical in controlling the insect population within a field. Many insects are attracted to weeds or debris, therefore, removal is necessary. Other cultural practices include field selection, avoiding second year plantings, pre-plant hot water bath for infested stock, sorting out contaminated berries. Recently, research on suction devices used to vacuum insects have been tried on lygus bugs with some success; however, there is concern that vacuums may increase existing problems with powdery mildew and gray mold. Solarization may be effective in controlling soil-dwelling arthropods, although more research is needed.

WEEDS. Strawberries are highly susceptible to weed competition immediately after planting when the plants are small and frequent watering provides ideal conditions for weed germination. Most weeds invading strawberry fields are annuals. Effective weed management in strawberries requires a combination of cultural practices, pre-plant soil fumigation, and additional herbicide applications. Appendix 5 encloses the UC Statewide Integrated Pest Management Project's summary of "Integrated Weed Management" for strawberries. The University of

California's publication, "Integrated Pest Management for Strawberries", also identifies and details the most important weed pests of strawberries in the different growing regions in California. A summary of their findings is as follows:

Central Coast	Santa Maria Valley	Oxnard Plain	South Coast	Interior Valleys	No. California Nurseries
little mallow burclover common groundsel sowthistle purslane chickweed filaree burning nettle bluegrass	little mallow burclover chickweed filaree	little mallow burclover shepherd's purse chickweed burning nettle	mallow sweet clover filaree lambsquarter pigweed shepherd's purse	barnyardgrass pigweed lambsquarter purslane sowthistle cudweed horseweed hairy fleabane crabgrass shepherd's purse	mallow sweetclover filaree vetch sowthistle

It is critical to keep weeds from getting established and out competing the young strawberry plants. Thorough hand weeding is labor intensive and expensive but is an alternative to chemical treatment. Other cultural practices include field selection, crop rotation and the use of opaque mulches, or IR selective films. Opaque polyethylene mulch greatly reduces weed growth in planting beds, however, it delays fruit production and can burn fruit when temperatures are above 90°F. Solarization is being researched as an alternative to pre-plant fumigation. It can be effective in areas where strong sunlight and high air temperature allow soil heating to a sufficient temperature to kill weed seeds and shallow growing perennials, such as bermuda grass rhizomes and nutsedge tubers.

Chemical weed treatment typically consists of a broad spectrum pre-plant fumigation containing methyl bromide. Even with pre-plant fumigation, windblown seeds resulting in weeds present a considerable problem to the strawberry grower. Herbicides , such as paraquat, DCPA, and sethoxydmim may play a role in managing weeds within a field; however, to avoid phytotoxic effects to the strawberry plants care must be taken in the application of such products.

NEMATODES. Damage from nematodes may result in plant stress and reductions in yield. Plant parasitic nematodes are microscopic, unsegmented roundworms that may be found in

the soil, as a parasite in roots, or aboveground on plant parts. The use of certified stock (produced in fumigated fields) combined with pre-plant fumigation with methyl bromide has been the primary management technique to date. The most common nematodes identified as pests in California strawberry fields are detailed in the UC Pest Management Guidelines (Appendix 6). The most common nematode pests are the following:

Foliar Nematode
Northern Root Knot Nematode.

Steps are taken by the strawberry industry to reduce the chance of nematode infestation. These practices include selecting tolerant cultivars and certified nursery stock, by analyzing field samples, and by taking steps to clean equipment to prevent the transfer of nematodes from an infested field to a clean field. Other cultural practices include planting when conditions are unfavorable for nematodes, crop rotation including fallow, and biological control.

Chemical treatment of nematodes begins with pre-plant soil fumigation with methyl bromide. Pre-plant applications may also be made with metam sodium, although steps must be taken in the application method to insure that this material get to the target organism. Oxamyl is registered for use on root knot and lesion nematodes on nonbearing nursery stock only, although some incidence of phytotoxicity has been reported for certain cultivars. 1,3-D (Telone II or Telone C35) has been demonstrated to be very effective against nematodes, but is not typically used by growers in California at this time due to severe restrictions related to the use of the products near urban areas (e.g.: rate restrictions near townships and buffer zones).

III. PEST MANAGEMENT ACTIVITIES AND PRACTICES:

California's strawberry industry relies on a combination of approaches to pest control. Biological control, cultural practices, pre-plant fumigation and chemical treatments are each components of the current pest management program. While cultural practices and biological controls are important facets of the pest management program, these non-chemical practices alone would not allow California growers to continue producing high quality fruit at a sufficient yield to remain both competitive and economically viable. The industry has relied on pre-plant fumigation with methyl bromide, in combination with chloropicrin, to control soil borne diseases, prevent weed germination, and to kill arthropods present in the soil. This broad spectrum fumigant has been used

in conjunction with cultural practices and biological control to provide a strong first defense in the control of pests common to strawberries. After planting, growers continue to utilize biological controls, such as natural predators, and cultural practices, such as field sanitation techniques to minimize the need for chemical treatments. However, it is in large part the use of chemical treatments, such as methyl bromide, that has resulted in relative economic stability for the California strawberry industry.

PRE-PLANT FUMIGATION. Pre-plant fumigation with Methyl bromide, used in combination with chloropicrin, is used throughout all of California's growing regions on almost all strawberry fields as well as in all nurseries during their propagation of planting strawberry stock. No single synthetic chemical or non-chemical option or any combination of practices and procedures has been found that can replace the efficacy of methyl bromide/chloropicrin broad-spectrum applications. The methyl bromide/chloropicrin pre-plant fumigation combination has proven efficacious for the following pests, as reported by the UCD Integrated Pest Management Program:

Arthropods:	Root weevils, cutworms, strawberry rootworm, white grubs, garden symphylan, ground mealybug.
Diseases:	Soil borne fungi that cause verticillium wilt, Phytophthora root and crown rots, anthracnose, black root rot, charcoal rot, and other soil-borne pathogens of unknown etiology that impact strawberry plant yield and quality.
Nematodes:	Foliar nematode, Root-knot nematodes
Weeds:	Seeds in all species except field bindweed, little mallow, burclover, sweetclovers and filaree.

OTHER TREATMENTS. Treatments with fungicides, insecticides and herbicides are applied to fields based on existing, increasing or potential pest pressures. Many diseases overwinter in fields, which is why pre-plant treatment with methyl bromide is important to control disease pressure. Appendix 1 is a table summarizing non-chemical and chemical treatments used by the strawberry industry as taken from information available from the UC IPM Program, the DPR

Survey and input from Pest Control Advisors.

Diseases, such as anthracnose which develops under warm or cool moist conditions, and Botrytis fruit rot (gray mold) which is prevalent in cool weather, can significantly reduce fruit yield. Captan and Benomyl are most commonly used by growers as a preventative treatment to control the outbreak of anthracnose. Repetitive treatments of vinclozolin, iprodione, Captan or thiram are used to treat Botyrtis fruit rot, a major fruit rot disease of California strawberries. Pest resistance to fungicides is a common problem that must be faced by growers utilizing chemical. Growers alternate chemicals, such as iprodione and vinclozolin with other products to minimize the potential for pest resistance.

Damage to strawberry plants and fruits from insects can be significant to growers throughout the state. Two-spotted spider mites and lygus bugs are two pests that can severely impact the quality and yield of strawberries. Damage from two-spotted mites to strawberry plants is heaviest during the first four months following planting and is seen as stippling, scarring and bronzing of the leaves and calyx. Avermectin is very effective in controlling two-spotted mites, but is expensive and requires multiple tratement. Other products registered for use, such as dicofol, febutatin oxide and potash soap, all have disadvantages including pest resistance, variable efficacy and phytotoxicity under certain conditions. Pest resistance to dicofol has been seen, which makes growers reluctant to use this product against two-spotted spider mites because it is one of the few products effective against cyclamen mite, and they would prefer to use this tool when it is needed for that pest.

Lygus bugs are a serious pest in the central and south coast growing regions, damaging seeds causing irregularly shaped strawberries. Lygus bugs are only susceptible to chemical treatments during the first or second instars. Growers commonly apply naled, malathion and methomyl to control young nymphs.

BIOLOGICAL CONTROLS. Biological Control is defined as the activity of any organism (parasite, predator, pathogen, antagonist, or competitor) that keeps a pest or pathogen population lower than it would otherwise exist. These organisms may be used to prevent infection or as colonists of the infected tissues to arrest pest or disease development.

Natural Enemies. Natural enemies contribute to the control of many insect and mite pests of strawberries.

NATURAL ENEMIES OF STRAWBERRY PESTS IN CALIFORNIA	
Pest	**Biological Control Agent**
Two-spotted spider mite	Predatory mites: *Phytoseiulus persimilis, Galendromus (metaseiulus) occidentalis, Amblyseiu (neoseilus) californicus*; six-spotted thrips; spider mite destroyers; minute pirate bugs; bigeyed bugs; lacewings, dusty wings, damsel bugs, predatory midges
Lygus bug	Parasitic wasps: ***Anaphes iole (A. ovijentatus), Leiophron uniformis***; bigeyed bugs; damsel bugs; minute pirate bugs; spiders
Cyclamen mite	Predatory mites: *Amblyseius (neoseilus) aurescnes, A. (N.) cucumeris, Galendromus (Metaseilus) occidentalis*; six-spotted thrips, minute pirate bugs
Aphids	Parasitic wasps: *Lysiphlebus testaceipes, Aphidius, Aphelinus*; fungal disease: *Entomophthora*; lacewings; bigeyed bugs; minute pirate bugs; dusty wings; damsel bugs, lady beetles
Caterpillar pests	Parasitic wasps: *Trichogramma, Macrocentrus, Hyposoter*, Copidosoma, *damsel bugs*; bigeyed bugs; lacewings; minute pirate bugs; nuclear polyhedrosis virus
Whiteflies	Parasitic wasps: *Encarsia*, bigeyed bugs; minute pirate bugs; lacewings

When evaluating needed pest control measures, the pest control adviser and the grower try to maximize the benefits of biological controls whenever possible, turning to chemical treatments when pest populations are no longer managed by biological controls or are expected to increase and cause significant crop damage. When treatments are necessary, growers give consideration to the beneficial insects and mites and select products carefully in an attempt to maintain as high a population of these beneficial biological control agents as possible.

CULTURAL CONTROLS. Good cultural practices, from field selection through handling of harvested fruit are essential to all growers for maximum yield of high-quality California strawberries. Many cultural practices have a significant effect on pest control. The following is a brief discussion of cultural practices common to most growers.

Field Selection. Deep, well-draining, sandy loam soils are best for strawberry production. The field should be easy to grade and have good air drainage so that cold air doesn't settle on the field. An adequate supply of good-quality water should be nearby. Soils are tested for salinity, and records of previous crops and herbicide use are reviewed.

Cultivar Selection. Strawberry cultivars are developed based on several factors including desired day length, and vigor. Cultivars vary in their susceptibility to some pests and abiotic disorders. Shifts in cultivar selection by growers has occurred in recent years. Central coast strawberry producers have shifted from exclusively summer-planting short-day cultivars (i.e. Tioga, Aiko, Tufts, Douglas and Pajaro) to primarily fall-transplanting the day-neutral cultivar "Selva. During the 1980's southern California strawberry producers shifted from later October or early November cultivars to early October transplanting of "Chandler", which was recently replaced by "Camerosa". The University of California's publication, "Integrated Pest Management for Strawberries" describes the characteristics of strawberry cultivars commonly grown in California as follows.

CULTIVAR	DAY LENGTH	PLANTING SEASON	COMMENTS & POTENTIAL PROBLEMS
Chandler	short	winter summer	somewhat tender skin
Douglas	short	winter	early production, potential for albino fruit, soft fruit in warm weather
Irvine	neutral	winter	early production; more susceptible to mites if vigor inadequate; more susceptible than short-day plants to powdery mildew
Muir	neutral	winter summer	more susceptible to mites if vigor inadequate; more susceptible than short-day plants to powdery mildew
Oso Grande	short	winter	albino fruit, splitting
Pajaro	short	summer	long season; susceptible to rain damage
Parker	short	winter	early production; susceptible to weather damage
Seascape	neutral	winter summer	more susceptible to mites if vigor inadequate; more susceptible than short-day plants to powdery mildew
Selva	neutral	winter summer	more susceptible to mites if vigor inadequate; more susceptible than short-day plants to powdery mildew

Sanitation. To help keep a field free of pathogens, soil-dwelling insects and weeds, growers utilize the following sanitation practices in addition to soil fumigation:

- use high-quality, certified pathogen-free transplants
- allow time between crops so that crowns from the previous strawberry crop are completely decomposed
- work cleanest fields first rinsing equipment with plain (hot) water to remove soil and plant debris before working another field,
- remove weeds from in and around the field before they produce seed
- ensure that manure or other organic amendments added to the field are properly composted or sterilized.

Crop Rotation. Strawberry fields are sometimes rotated with a cover crop, such as rye or barley, or with another cash crop, such as beans or broccoli, to reduce pest populations and improve soil structure. In areas where land costs are high, such as the south and central coast, planting non-cash cover crops are not economically feasible. Cash-crop rotation needs time to be effective, and the crop rotated into the field is often not as profitable as strawberries resulting in economic loss to the grower. Growers are sometimes reluctant to rotate crops because the value of the land is so high that a high value crop, like strawberries, is necessary to offset land and farming costs, or because they do not possess sufficient land to rotate crops. In addition, some soil-borne pests can survive for years in the soil which could reduce the success of a crop rotation program.

Cultural Practices and Field Preparation. Decisions related to various cultural practices are made daily by growers. Decisions related to field selection, soil nutrient supplements, and cultivars are made well in advance of planting. The growers design planting beds to allow proper drainage and irrigation. Time is allowed from one crop to another to allow any residues from previous treatment to decompose. Soil supplements and nutrients are added to fields to prepare soil for planting and sustaining crop. These are practices common to all growers. Clean tillage, raised beds, plastic mulches and water management are all important aspects of a systems approach practiced by California strawberry growers.

SYSTEMS APPROACHES. The California strawberry industry currently practices a pest management strategy that encompasses cultural, biological and chemical components. Cultural practices, such as field selection and preparation, use of certified plant stock, good soil preparation, bed design, field sanitation and crop rotation are critical components of the strawberry Industry's current and future pest management system. This system could reduce the need for conventional pesticides and/or lead to reduced rates of chemical treatment in the field.

IV. REVIEW OF PEST MANAGEMENT OPTIONS BEING CONSIDERED THAT MEET REDUCED-RISK OBJECTIVES:

Methyl bromide, a key component in California's strawberry industry pest management programs, has been determined to contribute to ozone depletion and will no longer be produced after 2001. As discussed in the previous sections, methyl bromide is a broad spectrum soil fumigant, and no other chemical or non-chemical tool has been identified that will replace it fully. The strawberry industry is currently researching new practices, both cultural and chemical, to identify effective reduced-risk pest management programs that will be able to replace the industry's use of methyl bromide. California's strawberry industry recognizes the need to become less reliant upon chemical treatments and to develop sound practices that will enhance pest control with as little chemical treatment as possible, yet maintaining fruit quality and yield. The industry's goal is to develop a pest management program that will encompass cultural, biological and chemical treatments to provide growers with the safest possible tools for continued economic success in the market. Due to the potential adverse impacts of methyl bromide on the environment and public health, the adoption of any pest management tool or program designed to substitute for the current reliance on methyl bromide would result in significantly reduced-risk.

The California Strawberry Commission together with experts from the United Stated Department of Agriculture, the University of California, and California's Integrated Waste Management Board have examined existing and new treatments that could reduce risks to workers, growers, the general public, and the overall environmental . These reduced risk components of the pest management system focus on cultural practices and application techniques. These components are the focus of the accompanying Pest Management Alliance Work Plan.

1. **Soil Solarization** - This technique involves covering moist soil with clear plastic and allowing the solar radiation to heat the top 2 to 6 inches of soil to temperatures high enough to kill soil-borne pathogens, nematodes and weed seeds. Solarization is seen as a potential alternative to soil fumigation or as a supplement to fumigation thus allowing lower use rates for fumigants. Solarization has the greatest potential for use in the central valley growing areas, where solar radiation is highest; although there may also be a potential for use in inland locations along the central coast where clouds, fog or winds do not prevent solar radiation from adequately heating the soil. Additional research is needed to define the conditions under which solarization will contribute to the pest management program and, if proven to be consistently effective, to educate the grower community to the benefits of solarization.

2. **Crop Rotation** - Crop rotation can be an effective method in suppression of disease and/or pests to annual crops. Strawberry fields are rotated with a cover crop, such as rye, barley and bell beans, or cash crops such as broccoli to enhance pest control and help improve soil structure. Cover crops enhance the health of the soil and can help suppress disease, but represent an economic loss to the grower. Crop rotation needs time to be developed into an effective pest management tool. The crop rotated into the field is often not as profitable as strawberries resulting in relative economic loss to the grower. Factors such as economic impact, disease control, and pesticide label restrictions need to researched and optimal parameters established in the development of this method of pest management.

3. **Organic Amendments/Mulching.** Organic amendments can be incorporated into the soil to improve the quality of the soil, and can be used on the soil surface to provide a barrier to help keep fumigants from escaping. With the help and guidance of the expertise within the California Integrated Waste Management Board, the California strawberry industry proposes to investigate the impacts of utilizing organic amendments or mulches from various specific waste streams established by the Board's authority on pest control. This use of California's unique, statewide waste management to focus on possible reduced-risk alternates to pesticides, is an innovative use of our state's resources.

4. **Reduced-Risk Application Methods.** With the assistance of our team members, several alternate application technologies are being proposed to dramatically reduce the potential harms from any future use of soil-borne pest controls. The following techniques are being evaluated:

- **Sub-Surface Drip Irrigation Systems.** Potential exposures and fumigant releases resulting from direct injection of pesticides could be significantly reduced through the use of sub-surface drip irrigation systems. The treatments being considered in this reduced-risk alternate to existing delivery techniques are:

  - **Telone C35 EC.** 1,3-D is almost as effective as methyl bromide as a broad-spectrum fumigant. It is not, however, used by most California growers due to restrictions associated with amounts allowed/township and buffer zones. A new emulsifiable concentrate formulation, not currently registered for use in California, when applied via sub-surface drip irrigation shows great promise in the control of air emission and efficacy and may allow for future use of this effective tool. Preliminary research in Texas has indicated that applications of the EC formulation through drip irrigation effectively controls air contamination reducing potential risk and exposure to applicators, growers and the public. More research under California conditions is needed to determine if this is a viable tool that could bridge the gap left by the loss of methyl bromide, while new pest management practices are proven effective and are made available to the California strawberry industry.

  - **Biological Control Agents.** Biological control agents are typically water suspendable and application via sub-surface drip irrigation systems may be a practical way to deliver these agents to the field. Research on biological control agents is new and more will have to be known about the efficacy of individual agents before field applications are made.

  - **Chloropicrin and Vapam.** These traditional pesticides may also benefit from solubilization in water and sub-surface drip irritation delivery systems..

- **High-Barrier Films.** These high barrier films which are essentially impermeable to the crop protection chemicals being usedentrap the soil-applied fumigant until it degrades, thereby reducing the emission from the fumigant, and may allow for reduced application rates of the fumigants since the material is held longer in the soil.

- **Chemical and Organic Barriers.** These chemical or organic barriers are supplements to plastic barriers and may be the pragmatic means to significantly reduce the potential risks of soil applied products.

- **Soil Conditions.** Experimentation is underway to identify the optimal soil conditions for reducing emissions and other potential hazards associated with treatments of soil-borne pests.

- **Application Rates.** Research is being performed to enhance the industry's understanding of the minimal rates needed for agronomic efficacy.

V. PEST MANAGEMENT CHALLENGES:

The California strawberry industry has achieved relative economic stability in recent years, with an estimated annual crop value of $580 million dollars, due in part to current pest management practices which rely heavily on the use of methyl bromide/chloropicrin treatments to control soil borne diseases, insects, and weeds. The problem facing the industry today is the impending loss of methyl bromide in 2001, a key component of the current pest management sytem. The industry faces the primary challenge of developing an effective, viable pest management program that will promote continued economic stability for the California strawberry industry.

The industry is developing a long-term pest management program that will couple reduced-risk chemical treatments with cultural practices, such as the use of high barrier films and solarization to achieve pest control. Efforts to determine the effectiveness and viability of these approaches is underway, although it could be several years before these pest control techniques become common cultural practices.

For the California strawberry industry to maintain an economically viable level of

production, it must face the short term challenge of finding a reasonably effective reduced-risk chemical treatment program that will not harm the ozone, threaten worker or public health, and will allow for the continued production of quality fruit. The long-term challenge faced by the industry is the development of a systems approach that can reduce the industry's use of and dependence on chemical treatments (by reducing rates of application, and/or the need for treatments) and increase the industry's reliance on reliable cultural practices, such as high barrier films, solarization, organic soil amendments, and crop rotation, used either alone or as a supplement to reduced-rate chemical treatments. Research to determine the efficacy of reduced risk chemical treatments (e.g.: sub-surface drip irrigation techniques) and cultural practices, alone and in combination are needed before these practices can be recommended to and implemented by growers.

Grower dependence on methyl bromide/chloropicrin is high, as there are currently no other broad-spectrum soil fumigant options available to the strawberry industry. The need for an efficacious control program to replace methyl bromide is critical to the industry. Challenges facing the industry include the identification of effective reduced-risk chemical treatments, the development of viable cultural controls, and grower acceptance and implementation of new practices.

The strawberry industry has reviewed both chemical treatments alone and in combination with cultural practices that have the potential to replace methyl bromide after it has been phased out, and has developed a work plan to address the industry's future needs for effective, economical chemical and non-chemical tools.

Reduced Risk Chemical Treatments. Methyl bromide is a toxic air contaminant that is a Toxicity Category I pesticide bearing the signal word "DANGER". It is a colorless, odorless gas that can potentially cause respiratory distress, cardiac arrest and central nervous system effects. It is highly regulated, restricted-use pesticide that can only be applied by teams of certified applicators. One pesticide that is an effective alternative to methyl bromide is 1,3-D . 1,3-D is currently registered as a restricted-use pesticide (Telone II, Telone C35) that is highly regulated and also identified as a toxic air contaminant in California. Use of 1,3-D in California is currently limited to 47,500 lbs of active ingredient (approximately 5,000 gallons of Telone II) per township per year due to concern with air quality impacts. A second use limitation for 1,3-D is the 300 foot buffer zone required from any occupied residence. Most strawberry fields are located in heavily populated areas and growers using 1,3-D are subject to these restrictions. Because of these limitations, growers do not typically apply 1,3-D to strawberry fields.

Dow AgroSciences has recently developed an emulsifiable concentrate formulation, Telone C35 EC, that can be applied through a closed system sub-surface drip irrigation system into fields. Telone C35 EC is not currently registered in California, but results of research conducted by the University of California to test the efficacy of the product when delivered via closed system irrigation have been promising. Closed-system delivery via sub-surface drip irrigation reduces potential air contamination, exposure to workers and to the public, and may result in reduced rate applications. This type of delivery system could address the 1,3-D use limitations that currently discourage growers from using this effective tool.

Reduced Risk Pesticide Use in Conjuction With Certain Cultural Practices. Certain cultural practices, when applied in conjunction with chemical treatments can result in reduced chemical application rates, reduced air emissions and reduced exposure potential to workers, the public and the environment. Research is still needed to determine the efficacy of Telone C35 EC when applied at full and reduced rates via a closed system drip irrigation system. Data is also needed to determine if the use of certain cultural practices, such as the use of high barrier film, crop rotation, organic supplements or supplemental solarization will sustain the product's efficacy at reduced application rates.

VI. INNOVATIONS COMPARED TO EXISTING PEST MANAGEMENT SYSTEMS:

The current pest management system utilized by the strawberry industry includes cultural practices, biological controls and chemical treatment. A key existing component of the industry"s pest management systems is pre-plant fumigation with methyl bromide/chloropicrin. This combination is used to control soil-borne diseases, nematodes, arthropods that are present in the soil, and prevent weed germination of many important weed species. Since methyl bromide will no longer be available to strawberry growers after 2001, the industry must look at new, innovative approaches to replace this important chemical tool.

For many years, the California strawberry industry has had economic success in great part because of the broad-spectrum efficacy of the pre-plant fumigant, methyl bromide. Innovative techniques are being considered as long term fundamental components of a systems approach for pest control for the strawberry industry. These practices may result in reduced pesticide application rates and possibly fewer needed applications. Research in these areas is innovative because these

methods of pest control are just now emerging as potential tools for the industry. These innovative and potential tools are described briefly as follows:

- **Sub-Surface Drip Irrigation Systems.** Significant reduction of potential exposures and fumigant releases resulting from direct injection of pesticides can potential be achieved through the use of sub-surface drip irrigation systems. Drip irrigation lines are placed under the surface of the soil where applications of water soluble products are applied directly into the soil. The soil helps trap the chemical material allowing for less emission and therefore risk, and prolonged soil contact and therefore increased efficacy of the product.

- **High-Barrier Films.** These high barrier films entrap the soil-applied product until it degrades, thereby reducing the emission from the chemical or fumigant, and allowing for reduced application rates since the material is held longer in the soil.

- **Chemical and Organic Barriers.** These chemical or organic barriers are supplements to plastic barriers and may be the pragmatic means to significantly reducing the potential risks of soil applied products.

- **Soil Conditions.** Experimentation is underway to identify the optimal soil conditions for reducing emissions and other potential hazards associated with treatments of soil-borne pests.

VII. POTENTIAL BARRIERS TO PROPOSED REDUCED-RISK METHODS:

The California strawberry industry must find viable alternatives, whether chemical or cultural, to the use of methyl bromide or it will face devastating economic impact. Potential barriers to the proposed reduced-risk methods include time, and funding.

The California strawberry industry must develop a viable pest management program that will replace the use of methyl bromide by 2001. Without a viable pest management program, the industry will face significant economic losses. Because there is little time, the industry must focus on the most promising short term solutions to fill the gap that will be left when methyl bromide is

no longer a pest management tool available to the industry. The most promising short term solutions are those that have been presented in the Pest Management Work Plan and have been discussed in this document.

The Pest Management Work Plan proposes a multi-faceted systems approach including research on sub-surface drip irrigation, solarization, high barrier films, crop rotation, and organic amendments/mulching. Experts experienced in each of these areas will be conducting the proposed research if funding is available. To date, matching funds have been committed to this research by the USDA, the California Integrated Waste Management Board, the University of California and the California Strawberry Commission. The PMA funding would allow for research to be expanded (sub-surface drip irrigation and solarization), while projects identified for future funding (organic mulching and high barrier films) could be done this year. Results of these studies and efficacy of the trials, would of course dictate implementation strategies.

VIII. CONCLUSIONS:

The strawberry industry has relied upon methyl bromide as a key tool in its pest management program. By the year 2001, the industry must develop an effective and viable program that will allow California growers to continue leading the nation in strawberry production. To be successful, this program will need to encompass all aspects of pest management, including cultural and chemical practices. New reduced-risk practices, such as soil solarization, crop rotation and reduced rate application methods, will be key components to a successful pest management system. Innovative research related to the treatment of soil-borne pathogens is critical to the continued success of the strawberry industry.

IX. REFERENCES:

Braun, A. and Supkoff, D. Options to Methyl Bromide for the Control of Soil-Borne Diseases and Pests in California. July 1994. California Department of Pesticide Regulation. (http://www.cdpr.ca.gov/docs/dprdocs).

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Management for Strawberries. 1994. University of California.

Statewide Integrated Pest Management Project, University of California. UC Pest Management Guidelines. University of California (http://www.ipm.ucdavis.edu).

X. APPENDICES:

1. California Strawberry Commission Pest Managment Evaluation Guideline.

2. Survey: Major Pests and Their Methods of Control in Strawberries in California.

3. UC Pest Management Guidelines - Pest Diseases

4. UC Pest Management Guidelines - Insects

5. UC Pest Management Guidelines - Integrated Weed Management

6. UC Pest Management Guidelines - Nematodes

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APPENDIX 1

CALIFORNIA STRAWBERRY COMMISSION
Pest Management Evaluation Guide

Information in this table was compiled from the UC IPM Project crop/pest profiles, results of the Pest Management Survey Database developed by DPR, the UC IPM Project and Pest Control Advisors .

PEST	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT[1]		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre[2]	Comments
DISEASES						
Angular Leaf Spot		Clean plant stock. Avoid overhead irrigation when possible	Pest reduces plant growth and fruit reducing yield by 10-20% during winter.	Fixed Coppers Methyl Bromide/ chloropicrin	 300-400 lbs	Repeated applications may be phytotoxic to plants. Preplant fumigation needed before next planting to kill disease left in soil from previous infected plants.
Anthracnose		Clean plant stock. Drip or furrow irrigation.	Pest can reduce yield by 50%.	Benomyl plus Captan 50 WP Iprodione	1 lb 4 lbs Label rates	Preventative fungicide treatments. Restricted Use Material.

PEST	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT[1]		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre[2]	Comments
Botrytis Fruit Rot		Remove and destroy dead leaves and infected fruit. Plastic mulches prevent berry-soil contact.		Anilazine	Label rates	
				Benomyl plus Captan 50 WP	1 lb 4 lbs	REI: 4 days. Potential resistance problems. Benomyl is rarely recommended by PCAs.
				Vinclozolin	1.5 lbs	Max use 4 times per season. Variable efficacy.
				Iprodione (Rovral)	1.5 lbs	Max use 4 times per season. Commonly recommended by PCAs.
				Captan 50 WP	4 lbs	REI: 4 days. Commonly recommended by PCAs.
				Thiram	Label rates	Commonly recommended by PCAs.
				Thiophanate-Methyl	0.75-1.0 lb	Tank mix with fungicide of different chemistry (Captan, thiram) to reduce resistance problems
						Resistance: To benomyl, iprodione, and vinclozolin. Alternate materials with different products.
Common Leaf Spot (significant economic impact)		Use resistant cultivars, and clean stock. Remove infected leaves. Drip irrigation.		Methyl Bromide/ Chloropicrin	300-400 lb	Pre-plant fumigation needed to kill overwintering disease.
				Chlorthalonil	2.0-2.75 pt	For Nursery Use Only (non-bearing strawberries).
				Benomyl	Label rates	
				Copper hydroxide	Label rates	Variable effectiveness.

PEST	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT[1]		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre[2]	Comments
Leather Rot		Avoid infested fields. Remove diseased fruit. Plastic mulches. Drip irrigation.	 Additional research needed. Additional research needed.	Methyl Bromide/ Chloropicrin Metalaxyl (Ridomil 2E)	300-400 lbs Label rates	Preplant fumigation. Do not use more than 6 qts/acre/year. Cost is prohibitive.
Mucor Fruit Rot		Remove plant debris. Remove all ripe fruit. Practice good sanitation during harvest, packing, transport and storage.		Iprodione Vinclozolin Captan 50 WP	1.5 lb 1.5 lb 1 - 4 lb	 REI: 4 days.
Phythophthora Root and Crown Rot		Raised beds. Drip irrigation. Use resistant cultivars and clean stock. Plant in noninfested fields with good drainage.		Methyl Bromide/ Chloropicrin Metalaxyl	300-400 lbs Label Rates	Preplant fumigant. Variable efficacy. Limited to 3 applications/ /crop/year.
Powdery Mildew		Avoid overhead irrigation. Use resistant cultivars. Use clean stock.		Sulfur Myclobutanil (Rally 40W) Insecticidal Soap	2.5 - 5.0 lbs 2.5 - 5.0 lbs 2.5 oz/gal	Application during high temperatures may burn foliage. Requires multiple treatments. PHI: 3 days. Apply in min. of 50 gal/acre. Sec. 18. Requires multiple treatments. PHI: 0 days. Not for use on new transplants, unrooted cuttings, or water-stressed plants.

PEST	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT[1]		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre[2]	Comments
Red Stele		Use resistant cultivars and clean stock. Raised beds. Drip irrigation. Keep soil pH at 7 or more.		Methyl Bromide/ Chloropicrin Metalaxyl	300-400 lb. Label Rates	Preplant fumigant. Only known control which is effective against disease. Variable efficacy. Limited to 3 applications/ /crop/year.
Rhizopus Fruit Rot		Field sanitation. Remove plant debris. Use resistant cultivars (those with thick cuticles).	Only known control which is effective against pest.			Typically does not cause excessive damage. Fungicide treatment is generally not recommended.
Verticillium Wilt		Avoid infested fields. Use resistant cultivars and clean stock. Drip irrigation. Crop rotation with nonsusceptible crop. Avoid high nitrogen fertilizers.		Methyl Bromide/ Chloropicrin Methyl isothiocyanate Metam Sodium	300-400 lb Label Rates Label Rates	Preplant fumigant. Kills beneficials and other non-target organisms. Preplant soil drench. Variable efficacy. Varibale efficacy.
Other, Unknown Etiology						

PEST	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT[1]		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre[2]	Comments
INSECTS AND MITES						
Aphids: Strawberry Aphid Melon Aphid Green Peach Aphid Potato Aphid	Predators: syrphid; or green lacewing larvae.	Row covers, plastic tunnels or Remay-type enclosures. Control dust to facilitate parasite and predator activity.	Random sampling. Treat chemically if infestation level reaches 30%. Natural predators are useful, but often appears too late in season.	Diazinon	1 lb	PHI: 5 days. Apply in 100 gal water/acre. May injure mite predators. Should be used with other control tactics. Not the treatment of choice.
				Insecticidal Soap	2.5 oz/gal	Apply in 100 gal water/acre. Possibly phytotoxic. Discolors fruit on repeat applications. Will kill approx. 50% of beneficial predatory mite eggs. Rarely used.
				Azadirachtin	Label rates	Additional research needed.
				Malathion	Lowest label rate	Most common treatment, but requires multiple applications.
				Naled	Label rates	Kills beneficial and non-target organisms. Rarely recommended by PCAs.
Beet Armyworm	Natural parasite: Hyposoter exigua	Weed control.	Monitor natural parasite population to determine if armyworms will be controlled by natural enemies. More research needed. Elimination of weed hosts should be used in conjunction with another tactic.	Bacillus Thuringiensis (Javelin) WG (Dipel) 2X	 1-1.25 lb 0.5-2 lb	Variable Efficacy. Requires multiple treatments. PHI: 0 days PHI: 0 days.
				Chlorpyrifos	Label rates	Kills beneficials and non-target organisms.
				Diazinon	Label rates	
				Endosulfan	Label rates	
				Methomyl	Label rates	Kills beneficials and non-target organisms. May be used as last resort at end of season.

PEST	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT[1]		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre[2]	Comments
Cabbage Looper	Parasitic wasps: Hyposoter exiguae; Copi-dosoma truncatellum; Trichogramma Disease: Nuclear polyhedrosis virus	Do not plant next to lettuce fields.	Additional research needed on biological control. Effectiveness dependent upon chemical treatment program.	Bacillus Thuringiensis (Dipel) 2X (Javelin) WG Chlorpyrifos	0.5-1 lb 0.25-0.5 lb Label rates	Use when loopers are in 1st or 2nd instar Kills beneficials and non-target organisms.
Corn Earworm	Parasitic wasps: Trichogramma pretiosum Predator: Minute pirate Bug	Plant early maturing sweet corn cultivar around fields.	Biocontrol agents provide some suppression; however, the very low tolerance for insect contamination makes this control less effective. Sweet corn diversion planting should be used in conjunction with another tactic.	Methomyl Lannate LV Lannate Chlorpyrifos Bacillus Thuringiensis	2-3 pts 1 lb Label rates Label rates	Kills beneficials and non-target organisms. PHI: 3 days (fresh) PHI: 10 days (processing Kills beneficials and non-target organisms. Recommended by PCAs.
Cutworms		Weed control. Avoid 2nd year plantings.		Bacillus Thuringiensis (Dipel) 2x (Javelin) WG Carbaryl (Sevin 5% Bait) Chloropicrin Diazinon Methyl Bromide	0.5-1 lb 0.5-1 lb 40 lbs Label rates Label rates Label rates	Variable efficacy. Requires multiple applications. PHI: 1 day. Effective. Effective. Used after planting at low cost. Kills beneficial and non-target organisms. Worker safety issues.

PEST	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT[1]		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre[2]	Comments
Cyclamen Mite	Predator Mites: Typhlodromus bellinus T. reticulatus Natural enemy: Sixspotted thrips	Clean stock. Pre-plant hot water bath for infested stock. Avoid 2nd year plantings in problem areas. Destroy rubbish near field.	Use in conjunction with another treatment. Variable effectiveness. More expensive. Must be used in conjunction with another treatment.	Avermectin Dicofol (Kelthane) 35 WP Endosulfan (Thiodan) 3EC Propargite	Label rates Label rates Label rates Label rates	More expensive. Temperature/season dependent. PHI: 2 days. Variable effectiveness. Potential resistance problems. PHI: 4 days. Variable effectiveness. Potential groundwater contamination. Potential phytotoxicity
European Earwig		Destroy rubbish near field.	Expensive.	Carbaryl (Sevin 5% bait)	40 lbs	
Fruit Fly		Completely remove ripe + fruit from plants. Shorten harvest intervals when temperatures increase. Good sanitation in and around field. Remove cull piles and other nearby rotting fruit.		Pyrethrin (Py-rin) Pyrethrin plus Piperonyl Butoxide (Py-rin 60-6) EC	4-20 oz 2-16 oz	
Garden Symphylan		Continuous flooding for 3 weeks in summer. Discing in sorghum.	Additional research is needed. Additional research is needed.			

PEs.	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT[1]		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre[2]	Comments
Garden Tortrix		Remove accumulated trash in Spring.	Significant labor needed.	Bacillus Thuringiensis (Dipel) 2X	0.5-1 lb	PHI: 0 days.
		Sort out contaminated berries.	Significant labor needed.			
		Avoid 2nd year plantings.	Expensive.			
Lygus Bugs	Predators: Bigeyed bugs Damsel bugs Minute pirate bugs spiders	Weed control along roadways, ditches and field borders.	Variable efficacy. Must be used in conjunction with another tactic.	Naled (Dibron) 8 EC	1 pt.	PHI: 1 day. Kills beneficial and non-target organisms. Ineffective on certain species.
		Mow or disc under cover crop when lygus are still in nymphal stages.		Malathion 5EC 25WP	1.5-3 pts 6 lbs	PHI: 3 days. Variable effectiveness. Requires multiple treatments. Short or no residual.
		Bug vacuums.	Vacuuming may increase problems with powdery mildew and gray mold.	Methomyl Lannate Lannate LV	1 lb 3 pt	PHI: 3 days (fresh), 10 days (processing. Variable effectiveness. Requires multiple treatments. Kills beneficials and non-target organisms.
				Insecticidal Soap M-Pede	2.5 oz/gal water	
				Diazinon	Label rates	Requires multiple treatments. Variable effectiveness. Must be used in conjunction with another tactic.
				Methyl Bromide	Label rates	
				Petroleum Distillates, aromatic	Label rates	Variable effectiveness.
				Pyrethrins	Label rates	Variable effectiveness. More expensive. Lower yield, lower grade.

PEST	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT[1]		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre[2]	Comments
Western Flower Thrips	Predator: Minute pirate bugs		Minute pirate bugs feed on thrips, but thrips feed on twospotted spider and cyclamen mites. Control is not usually necessary because this pest rarely causes economic damage.			
Whiteflies			Pest is an increasing problem. Impacts market quality and yield.	Potash Soap	Label rates	Variable efficacy. Problems with phytotoxicity.
NEMATODES						
Nematodes - lesion, stem, dagger, needle, foliar, and root knot		Tolerant cultivars and certified nursery stock. Field soil sample analysis. Pre-plant hot water treatments for stock. Clean equipment to prevent transfer of nematodes. Crop rotation following fallow.	Cultural practices can be expensive and time consuming and can require pre-planning.	Methyl Bromide/ Chloropicrin Metam Sodium Oxamyl Chloropicrin	300-400 lbs Label rates Label rate Label rates	Preplant control. Very effective. Preplant applications. Variable, but satisfactory control with proper application techniques. Only registered for use on root knot and lesion nematodes on nonbearing nursery stock. May be phytotoxic to some cultivars. More research needed for efficacy.

PEST	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT[1]		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre[2]	Comments
Western Flower Thrips	Predator: Minute pirate bugs		Minute pirate bugs feed on thrips, but thrips feed on twospotted spider and cyclamen mites. Control is not usually necessary because this pest rarely causes economic damage.			
Whiteflies			Pest is an increasing problem. Impacts market quality and yield.	Potash Soap	Label rates	Variable efficacy. Problems with phytotoxicity.
NEMATODES						
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PEST	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT[1]		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre[2]	Comments
WEEDS						
Weeds, such as: Barley Barnyardgrass Bluegrass Burning nettle Common chickweed Common groundsel Filaree Little mallow		Opaque plastic mulches. Organic mulches: wood shavings, chopped straw, rice hulls. Solarization.	Need additional research.	Pre-plant: Methyl Bromide/ Chloropicrin Metam Sodium DCPA Dacthal W-75 Preplant : Post-emergence of Weed: Paraquat Gramoxone Extra Postplant - preemergence of Weed: DCPA Dacthal W-75 Napropamide Devrinol Postplant: post-emergence of weed Sethyoxydim	200-238 lbs 100-150 lbs 238-318 lbs 6-9 lb 0.5 lb 6-9 lbs 2-4 lbs 0.38-0.47 lb	Applied to pre-irrigated soil. Must be tarped. Very effective. Applied to pre-irrigated soil. May inhibit strawberry runners. PHI: 7 days. Only 1 application per season allowed. Control varies with species.

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1.Based on information from UCD IPM Program. This guide is not intended as a recommendation for use. See California-registered product labels for specific label rates and use directions.

2.Rates/200 gallons water/acre unless noted otherwise.

APPENDIX 2

Major pests and their methods of control in strawberries in California, from a survey

This table lists chemic[al] and non-chemical control methods for the major pests on strawberries in California. Explanations of t[he] [co]lumns is given in the following table. Data is from the 1996 Pest Management Survey Database, which [was] developed jointly by DPR and the UC [Ba]sic IPM Project. Department of Pesticide Regulation-- April 15, 1996

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Re stat	Meet market standards	Yield red.	Svy se	Comments
ALFALFA LOOPER	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		?	SOMETIMES	10	39	
ALFALFA LOOPER	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2			G		N	ALWAYS	0	1	
ALFALFA LOOPER	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	S COAST	2			G		N	ALWAYS	0	1	
ALFALFA LOOPER	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	SAN JQ	2			G		N	ALWAYS	0	1	
ANGULAR LEAF SPOT (XANTHOMONAS FRAGARIAE)	PATHOGEN	AVOID OVERHEAD IRRIGATION.	COASTAL	0		ADDITIONAL RESEARCH IS NEEDED				RARE	10	39	
ANGULAR LEAF SPOT (XANTHOMONAS FRAGARIAE)	PATHOGEN	CLEAN PLANTING STOCK.	COASTAL	2		ADDITIONAL RESEARCH IS NEEDED				RARE	10	39	
ANGULAR LEAF SPOT (XANTHOMONAS FRAGARIAE)	PATHOGEN	VINCLOZOLIN	COASTAL	0			G	A	N	ALWAYS	0	4	
ANGULAR LEAF SPOT (XANTHOMONAS FRAGARIAE)	PATHOGEN	VINCLOZOLIN	COASTAL	0								39	
ANGULAR LEAF SPOT (XANTHOMONAS FRAGARIAE)	PATHOGEN	VINCLOZOLIN	S COAST	0			G	A	N	ALWAYS	0	4	
ANTHRACNOSE (COLLETOTRICHUM ACUTATUM)	PATHOGEN	BENOMYL	COASTAL	2			G		N	ALWAYS		4	
ANTHRACNOSE (COLLETOTRICHUM ACUTATUM)	PATHOGEN	BENOMYL	S COAST	2			G		N	ALWAYS		4	
ANTHRACNOSE (COLLETOTRICHUM ACUTATUM)	PATHOGEN	CLEAN PLANTING STOCK.	COASTAL	2		ADDITIONAL RESEARCH IS NEEDED				SOMETIMES	20	39	
ANTHRACNOSE (COLLETOTRICHUM ACUTATUM)	PATHOGEN	DRIP OR FURROW IRRIGATION.	COASTAL	0								39	
ANTHRACNOSE (COLLETOTRICHUM ACUTATUM)	PATHOGEN	IPRODIONE	COASTAL	2		RESTRICTED USE MATERIAL	G	A	N	ALWAYS	0	4	
ANTHRACNOSE (COLLETOTRICHUM ACUTATUM)	PATHOGEN	IPRODIONE	S COAST	2		RESTRICTED USE MATERIAL	G	A	N	ALWAYS	0	4	
APHIDS	INSECTS	AZADIRACHTIN	COASTAL	4		ADDITIONAL RESEARCH IS NEEDED	G			UNKNOWN	?	1	
APHIDS	INSECTS	AZADIRACHTIN	S COAST	4		ADDITIONAL RESEARCH IS NEEDED	G			UNKNOWN	?	1	
APHIDS	INSECTS	AZADIRACHTIN	SAN JQ	4		ADDITIONAL RESEARCH IS NEEDED	G			UNKNOWN	?	1	
APHIDS	INSECTS	DIAZINON	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC	G	A	?	FREQUENTLY	5	1	
APHIDS	INSECTS	DIAZINON	COASTAL	3	IT PROVIDES A SHORT WORKER RE-ENTRY INTERVAL	ADDITIONAL RESEARCH IS NEEDED	G		?	FREQUENTLY	5	39	
APHIDS	INSECTS	DIAZINON	COASTAL	3	IT PROVIDES A SHORT WORKER RE-ENTRY INTERVAL	WEAK OR INEFFECTIVE ON PARTICULAR SPECIES	G		?	FREQUENTLY	5	39	
APHIDS	INSECTS	DIAZINON	S COAST	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC	G	A	?	FREQUENTLY	5	1	
APHIDS	INSECTS	DIAZINON	SAN JQ	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC	G	A	?	FREQUENTLY	5	1	
APHIDS	INSECTS	MALATHION	COASTAL	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	FREQUENTLY	10	1	
APHIDS	INSECTS	MALATHION	COASTAL	2		SHORT OR NO RESIDUAL	G		Y	FREQUENTLY	10	1	
APHIDS	INSECTS	MALATHION	S COAST	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	FREQUENTLY	10	1	
APHIDS	INSECTS	MALATHION	S COAST	2		SHORT OR NO RESIDUAL	G		Y	FREQUENTLY	10	1	
APHIDS	INSECTS	MALATHION	SAN JQ	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	FREQUENTLY	10	1	
APHIDS	INSECTS	MALATHION	SAN JQ	2		SHORT OR NO RESIDUAL	G		Y	FREQUENTLY	10	1	
APHIDS	INSECTS	NALED	COASTAL	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	10	1	
APHIDS	INSECTS	NALED	S COAST	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	10	1	
APHIDS	INSECTS	NALED	SAN JQ	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	10	1	
BARLEY	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE							39	
BARNYARDGRASS	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE							39	
BEET ARMYWORM	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		?	SOMETIMES	10	39	
BEET ARMYWORM	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	5	1	
BEET ARMYWORM	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	FREQUENTLY	5	1	

Major pests and their methods of control in strawberries in California, from a survey

This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations of the columns is given in the following table. Data is from the 1998 Pest Management Survey Database, which was developed jointly by DPR and the UC Statewide IPM Project. Department of Pesticide Regulation-- April 15, 1998

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Resistant	Meet market standards	Yield red.	Survive	Comments
BEET ARMYWORM	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	S COAST	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	5	1	
BEET ARMYWORM	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	S COAST	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	FREQUENTLY	5	1	
BEET ARMYWORM	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	SAN JQ	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	5	1	
BEET ARMYWORM	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	SAN JQ	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	FREQUENTLY	5	1	
BEET ARMYWORM	INSECTS	CHLORPYRIFOS	COASTAL	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	1	1	
BEET ARMYWORM	INSECTS	CHLORPYRIFOS	S COAST	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	1	1	
BEET ARMYWORM	INSECTS	CHLORPYRIFOS	SAN JQ	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	1	1	
BEET ARMYWORM	INSECTS	DIAZINON	COASTAL	2			G	A	?	FREQUENTLY	5	1	
BEET ARMYWORM	INSECTS	DIAZINON	S COAST	2			G	A	?	FREQUENTLY	5	1	
BEET ARMYWORM	INSECTS	DIAZINON	SAN JQ	2			G	A	?	FREQUENTLY	5	1	
BEET ARMYWORM	INSECTS	ELIMINATE WEED HOSTS.	COASTAL	0	OTHER	ADDITIONAL RESEARCH IS NEEDED				NEVER	10	39	
BEET ARMYWORM	INSECTS	ELIMINATE WEED HOSTS.	COASTAL	2		LESS/VARIABLE EFFECTIVENESS				FREQUENTLY	5	1	
BEET ARMYWORM	INSECTS	ELIMINATE WEED HOSTS.	COASTAL	2		LOWER YIELD/LOWER GRADE				FREQUENTLY	5	1	
BEET ARMYWORM	INSECTS	ELIMINATE WEED HOSTS.	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	5	1	
BEET ARMYWORM	INSECTS	ELIMINATE WEED HOSTS.	S COAST	1		LESS/VARIABLE EFFECTIVENESS				SOMETIMES	10	1	
BEET ARMYWORM	INSECTS	ELIMINATE WEED HOSTS.	S COAST	1		LOWER YIELD/LOWER GRADE				SOMETIMES	10	1	
BEET ARMYWORM	INSECTS	ELIMINATE WEED HOSTS.	S COAST	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	10	1	
BEET ARMYWORM	INSECTS	ELIMINATE WEED HOSTS.	SAN JQ	0		LESS/VARIABLE EFFECTIVENESS				FREQUENTLY	5	1	
BEET ARMYWORM	INSECTS	ELIMINATE WEED HOSTS.	SAN JQ	0		LOWER YIELD/LOWER GRADE				FREQUENTLY	5	1	
BEET ARMYWORM	INSECTS	ELIMINATE WEED HOSTS.	SAN JQ	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	5	1	
BEET ARMYWORM	INSECTS	ENDOSULFAN	COASTAL	0								39	
BEET ARMYWORM	INSECTS	ENDOSULFAN	COASTAL	4								1	
BEET ARMYWORM	INSECTS	ENDOSULFAN	S COAST	4								1	
BEET ARMYWORM	INSECTS	ENDOSULFAN	SAN JQ	4								1	
BEET ARMYWORM	INSECTS	HYPOSOTER EXIGUA AND A VIRUS.	COASTAL	0	OTHER	ADDITIONAL RESEARCH IS NEEDED				NEVER	10	39	
BEET ARMYWORM	INSECTS	HYPOSOTER EXIGUA AND A VIRUS.	COASTAL	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				SOMETIMES	5	1	
BEET ARMYWORM	INSECTS	HYPOSOTER EXIGUA AND A VIRUS.	COASTAL	1		LESS/VARIABLE EFFECTIVENESS				SOMETIMES	5	1	
BEET ARMYWORM	INSECTS	HYPOSOTER EXIGUA AND A VIRUS.	S COAST	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				SOMETIMES	10	1	
BEET ARMYWORM	INSECTS	HYPOSOTER EXIGUA AND A VIRUS.	S COAST	1		LESS/VARIABLE EFFECTIVENESS				SOMETIMES	10	1	
BEET ARMYWORM	INSECTS	HYPOSOTER EXIGUA AND A VIRUS.	SAN JQ	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				SOMETIMES	5	1	
BEET ARMYWORM	INSECTS	HYPOSOTER EXIGUA AND A VIRUS.	SAN JQ	1		LESS/VARIABLE EFFECTIVENESS				SOMETIMES	5	1	
BEET ARMYWORM	INSECTS	METHOMYL	COASTAL	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		?	ALWAYS	5	1	
BEET ARMYWORM	INSECTS	METHOMYL	COASTAL	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	SOMETIMES	5	39	
BEET ARMYWORM	INSECTS	METHOMYL	S COAST	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		?	FREQUENTLY	5	1	
BEET ARMYWORM	INSECTS	METHOMYL	SAN JQ	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		?	ALWAYS	5	1	
BLACK ROOT ROT (PYTHIUM)	PATHOGEN	CHLOROPICRIN	COASTAL	4			F		N	ALWAYS	0	4	
BLACK ROOT ROT (PYTHIUM)	PATHOGEN	CHLOROPICRIN	S COAST	4			F		N	ALWAYS	0	4	
BLACK ROOT ROT (PYTHIUM)	PATHOGEN	IPRODIONE	COASTAL	2		RESTRICTED USE MATERIAL	G	A	N	ALWAYS	0	4	
BLACK ROOT ROT (PYTHIUM)	PATHOGEN	IPRODIONE	S COAST	2		RESTRICTED USE MATERIAL	G	A	N	ALWAYS	0	4	
BLACK ROOT ROT (PYTHIUM)	PATHOGEN	METHYL BROMIDE	COASTAL	3	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST		F		N	ALWAYS		4	
BLACK ROOT ROT (PYTHIUM)	PATHOGEN	METHYL BROMIDE	COASTAL	4		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	0	4	
BLACK ROOT ROT (PYTHIUM)	PATHOGEN	METHYL BROMIDE	S COAST	3	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST		F		N	ALWAYS		4	
BLACK ROOT ROT (PYTHIUM)	PATHOGEN	METHYL BROMIDE	S COAST	4		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	0	4	
BLACK VINE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTING	COASTAL	2		MORE EXPENSIVE				FREQUENTLY ?		1	
BLACK VINE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTING	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY ?		1	
BLACK VINE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTING	S COAST	2		MORE EXPENSIVE				FREQUENTLY ?		1	

Major pests and their methods of control in strawberries in California, from a survey

This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations of f ' 'umns is given in the following table. Data is from the 1996 Pest Management Survey Database, whic eveloped jointly by DPR and the UC ' 'de IPM Project. Department of Pesticide Regulation-- April 15, 1996

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Resistant	Meet market standards	Yield red.	Surv ee	Comments
BLACK VINE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTING	S COAST	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	?	1	
BLACK VINE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTING	SAN JQ	1		MORE EXPENSIVE				FREQUENTLY	?	1	
BLACK VINE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTING	SAN JQ	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		MORE EXPENSIVE				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		SIGNIFICANT LABOR REQUIRED				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	4	OTHER	MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	40	39	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		MORE EXPENSIVE				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		SIGNIFICANT LABOR REQUIRED				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		MORE EXPENSIVE				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		SIGNIFICANT LABOR REQUIRED				UNKNOWN	?	1	
BLUEGRASS	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE							39	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	ANILAZINE	COASTAL	0								39	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	BENOMYL	COASTAL	2		POTENTIAL RESISTANCE PROBLEMS	G	A	N	ALWAYS	0	4	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	BENOMYL	S COAST	2		POTENTIAL RESISTANCE PROBLEMS	G	A	N	ALWAYS	0	4	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	CAPTAN	COASTAL	2	IT PROVIDES A SHORT WORKER RE-ENTRY INTERVAL		G		N	ALWAYS	0	4	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	CAPTAN	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC	G		Y	SOMETIMES	10	39	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	CAPTAN	S COAST	2	IT PROVIDES A SHORT WORKER RE-ENTRY INTERVAL		G		N	ALWAYS	0	4	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	REMOVAL & DESTRUCTION OF DEAD OR INFECTED PLANT MATERIAL.	COASTAL	2		ADDITIONAL RESEARCH IS NEEDED				SOMETIMES	20	39	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	USE PLASTIC MULCHES TO PREVENT BERRY-SOIL CONTACT.	COASTAL	2		ADDITIONAL RESEARCH IS NEEDED				SOMETIMES	20	39	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	VINCLOZOLIN	COASTAL	2			G	A	N	ALWAYS	0	4	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	VINCLOZOLIN	S COAST	2			G	A	N	ALWAYS	0	4	
BURNING NETTLE	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE							39	
CABBAGE LOOPER	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2			G		N	ALWAYS	1	1	
CABBAGE LOOPER	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	S COAST	2			G		N	ALWAYS	1	1	
CABBAGE LOOPER	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	SAN JQ	2			G		N	ALWAYS	1	1	
CABBAGE LOOPER	INSECTS	CHLORPYRIFOS	COASTAL	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	0	1	
CABBAGE LOOPER	INSECTS	CHLORPYRIFOS	S COAST	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	0	1	
CABBAGE LOOPER	INSECTS	CHLORPYRIFOS	SAN JQ	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	0	1	
CABBAGE LOOPER	INSECTS	ELIMINATE WEED HOSTS	COASTAL	0	OTHER	ADDITIONAL RESEARCH IS NEEDED				NEVER	10	39	
CABBAGE LOOPER	INSECTS	HYPOSOTER EXIGUA AND A VIRUS.	COASTAL	0	OTHER	ADDITIONAL RESEARCH IS NEEDED				NEVER	10	39	
CABBAGE LOOPER	INSECTS	HYPOSOTER EXIGUAE, CODIDOSOMA TRUNCATELLUM & NPV.	COASTAL	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				FREQUENTLY	5	1	
CABBAGE LOOPER	INSECTS	HYPOSOTER EXIGUAE, CODIDOSOMA TRUNCATELLUM & NPV.	COASTAL	1		LESS/VARIABLE EFFECTIVENESS				FREQUENTLY	5	1	

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This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations of th mns is given in the following table. Data is from the 1996 Pest Management Survey Database, whic veloped jointly by DPR and the UC / te IPM Project. Department of Pesticide Regulation– April 15, 1998

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Resist	Meet market standards	Yield red.	Svy se	Comments
CABBAGE LOOPER	INSECTS	HYPOSOTER EXIGUAE, CODIDOSOMA TRUNCATELLUM & NPV.	S COAST	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				ALWAYS	1	1	
CABBAGE LOOPER	INSECTS	HYPOSOTER EXIGUAE, CODIDOSOMA TRUNCATELLUM & NPV.	S COAST	1		LESS/VARIABLE EFFECTIVENESS				ALWAYS	1	1	
CABBAGE LOOPER	INSECTS	HYPOSOTER EXIGUAE, CODIDOSOMA TRUNCATELLUM & NPV.	SAN JQ	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				ALWAYS	1	1	
CABBAGE LOOPER	INSECTS	HYPOSOTER EXIGUAE, CODIDOSOMA TRUNCATELLUM & NPV.	SAN JQ	1		LESS/VARIABLE EFFECTIVENESS				ALWAYS	1	1	
CITRUS THRIPS	INSECTS	FORMETANATE HYDROCHLORIDE	COASTAL	0								39	
CITRUS THRIPS	INSECTS	FORMETANATE HYDROCHLORIDE	S COAST	4								1	
COMMON CHICKWEED	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE							39	
COMMON GROUNDSEL	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE							39	
COMMON LAMBSQUARTERS	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE							39	
COMMON LEAF SPOT (RAMULARIA)	PATHOGEN	BENOMYL	COASTAL	2			G		N	ALWAYS		4	
COMMON LEAF SPOT (RAMULARIA)	PATHOGEN	BENOMYL	S COAST	2			G		N	ALWAYS		4	
COMMON LEAF SPOT (RAMULARIA)	PATHOGEN	COPPER HYDROXIDE	COASTAL	3	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST	LESS/VARIABLE EFFECTIVENESS	G	A	N	ALWAYS	1	4	
COMMON LEAF SPOT (RAMULARIA)	PATHOGEN	COPPER HYDROXIDE	S COAST	3	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST	LESS/VARIABLE EFFECTIVENESS	G	A	N	ALWAYS	1	4	
COMMON LEAF SPOT (RAMULARIA)	PATHOGEN	DRIP IRRIGATION.	COASTAL	0								39	
COMMON LEAF SPOT (RAMULARIA)	PATHOGEN	ENSURE PLANTING STOCK IS CLEAN.	COASTAL	4	OTHER							39	
COMMON LEAF SPOT (RAMULARIA)	PATHOGEN	REMOVE INFECTED LEAVES WHEN PRACTICAL.	COASTAL	0								39	
CORN EARWORM	INSECTS	CHLORPYRIFOS	COASTAL	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	5	1	
CORN EARWORM	INSECTS	CHLORPYRIFOS	S COAST	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	5	1	
CORN EARWORM	INSECTS	CHLORPYRIFOS	SAN JQ	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	5	1	
CORN EARWORM	INSECTS	METHOMYL	COASTAL	1		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		?	ALWAYS	5	1	
CORN EARWORM	INSECTS	METHOMYL	S COAST	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		?	FREQUENTLY	5	1	
CORN EARWORM	INSECTS	METHOMYL	SAN JQ	1		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		?	ALWAYS	5	1	
CORN EARWORM	INSECTS	PLANT VERY EARLY MATURING SWEET CORN AROUND STRAWBERRY FIELDS.	COASTAL	0	OTHER	ADDITIONAL RESEARCH IS NEEDED				RARE		39	
CORN EARWORM	INSECTS	PLANT VERY EARLY MATURING SWEET CORN AROUND STRAWBERRY FIELDS.	COASTAL	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
CORN EARWORM	INSECTS	PLANT VERY EARLY MATURING SWEET CORN AROUND STRAWBERRY FIELDS.	COASTAL	0		LOWER YIELD/LOWER GRADE				UNKNOWN	?	1	
CORN EARWORM	INSECTS	PLANT VERY EARLY MATURING SWEET CORN AROUND STRAWBERRY FIELDS.	COASTAL	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				UNKNOWN	?	1	
CORN EARWORM	INSECTS	PLANT VERY EARLY MATURING SWEET CORN AROUND STRAWBERRY FIELDS.	S COAST	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
CORN EARWORM	INSECTS	PLANT VERY EARLY MATURING SWEET CORN AROUND STRAWBERRY FIELDS.	S COAST	0		LOWER YIELD/LOWER GRADE				UNKNOWN	?	1	
CORN EARWORM	INSECTS	PLANT VERY EARLY MATURING SWEET CORN AROUND STRAWBERRY FIELDS.	S COAST	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				UNKNOWN	?	1	
CORN EARWORM	INSECTS	PLANT VERY EARLY MATURING SWEET CORN AROUND STRAWBERRY FIELDS.	SAN JQ	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
CORN EARWORM	INSECTS	PLANT VERY EARLY MATURING SWEET CORN AROUND STRAWBERRY FIELDS.	SAN JQ	0		LOWER YIELD/LOWER GRADE				UNKNOWN	?	1	
CORN EARWORM	INSECTS	PLANT VERY EARLY MATURING SWEET CORN AROUND STRAWBERRY FIELDS.	SAN JQ	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				UNKNOWN	?	1	
CORN EARWORM	INSECTS	TRICHOGRAMMA PRETIOSUM & MINUTE PIRATE BUG.	COASTAL	0	OTHER	ADDITIONAL RESEARCH IS NEEDED				RARE		39	
CORN EARWORM	INSECTS	TRICHOGRAMMA PRETIOSUM & MINUTE PIRATE BUG.	COASTAL	0		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				UNKNOWN	?	1	
CORN EARWORM	INSECTS	TRICHOGRAMMA PRETIOSUM & MINUTE PIRATE BUG.	COASTAL	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
CORN EARWORM	INSECTS	TRICHOGRAMMA PRETIOSUM & MINUTE PIRATE BUG.	S COAST	0		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				UNKNOWN	?	1	
CORN EARWORM	INSECTS	TRICHOGRAMMA PRETIOSUM & MINUTE PIRATE BUG.	S COAST	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	

Major pests and their methods of control in strawberries in California, from a survey

This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations of columns is given in the following table. Data is from the 1996 Pest Management Survey Database, wh developed jointly by DPR and the U wide IPM Project. Department of Pesticide Regulation-- April 15, 1998

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Resist	Meet market standards	Yield red.	Svy se	Comments
CORN EARWORM	INSECTS	TRICHOGRAMMA PRETIOSUM & MINUTE PIRATE BUG.	S COAST	0		LOWER YIELD/LOWER GRADE				UNKNOWN	?	1	
CORN EARWORM	INSECTS	TRICHOGRAMMA PRETIOSUM & MINUTE PIRATE BUG.	SAN JQ	0		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				UNKNOWN	?	1	
CORN EARWORM	INSECTS	TRICHOGRAMMA PRETIOSUM & MINUTE PIRATE BUG.	SAN JQ	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
COTTON MELON APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	4 OTHER		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	0	39	
COTTON MELON APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	4								1	
COTTON MELON APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	S COAST	4								1	
COTTON MELON APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	SAN JQ	4								1	
COTTON MELON APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	0								39	
COTTON MELON APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	4								1	
COTTON MELON APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	S COAST	4								1	
COTTON MELON APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	SAN JQ	4								1	
CRIBRATE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTINGS	COASTAL	2		MORE EXPENSIVE				FREQUENTLY	?	1	
CRIBRATE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTINGS	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	?	1	
CRIBRATE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTINGS	S COAST	2		MORE EXPENSIVE				FREQUENTLY	?	1	
CRIBRATE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTINGS	S COAST	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	?	1	
CRIBRATE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTINGS	SAN JQ	1		MORE EXPENSIVE				FREQUENTLY	?	1	
CRIBRATE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTINGS	SAN JQ	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	?	1	
CRIBRATE WEEVIL	INSECTS	CHLOROPICRIN	COASTAL	2		WORKER SAFETY/HANDLING	F		N	ALWAYS	0	1	
CRIBRATE WEEVIL	INSECTS	CHLOROPICRIN	S COAST	2		WORKER SAFETY/HANDLING	F		N	ALWAYS	0	1	
CRIBRATE WEEVIL	INSECTS	CHLOROPICRIN	SAN JQ	2		WORKER SAFETY/HANDLING	F		N	ALWAYS	0	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		MORE EXPENSIVE				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		SIGNIFICANT LABOR REQUIRED				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	4 OTHER		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	40	39	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		MORE EXPENSIVE				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		SIGNIFICANT LABOR REQUIRED				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		MORE EXPENSIVE				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		SIGNIFICANT LABOR REQUIRED				UNKNOWN	?	1	
CUTWORMS	INSECTS	AVOID SECOND YEAR PLANTINGS.	COASTAL	2		MORE EXPENSIVE				SOMETIMES	5	1	
CUTWORMS	INSECTS	AVOID SECOND YEAR PLANTINGS.	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	5	1	
CUTWORMS	INSECTS	AVOID SECOND YEAR PLANTINGS.	S COAST	2		MORE EXPENSIVE				FREQUENTLY	1	1	
CUTWORMS	INSECTS	AVOID SECOND YEAR PLANTINGS.	S COAST	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	1	1	
CUTWORMS	INSECTS	AVOID SECOND YEAR PLANTINGS.	SAN JQ	1		MORE EXPENSIVE				FREQUENTLY	1	1	

This table lists chem[illegible] by DPR and the UC [illegible]d non-chemical control methods for the major pests on strawberries in California. Explanations of [illegible]mns is given in the following table. Data is from the 1996 Pest Management Survey Database, whi[illegible] developed jointly

Major pests and their methods of control in strawberries in California, from a survey

[illegible]ide IPM Project. Department of Pesticide Regulation-- April 15, 1996

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Resist	Meet market standards	Yield red.	Svy ee	Comments
CUTWORMS	INSECTS	AVOID SECOND YEAR PLANTINGS.	SAN JQ	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	1	1	
CUTWORMS	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		?	FREQUENTLY	10	39	
CUTWORMS	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	5	1	
CUTWORMS	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	FREQUENTLY	5	1	
CUTWORMS	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	S COAST	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	5	1	
CUTWORMS	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	S COAST	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	FREQUENTLY	5	1	
CUTWORMS	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	SAN JQ	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	5	1	
CUTWORMS	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	SAN JQ	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	FREQUENTLY	5	1	
CUTWORMS	INSECTS	CARBARYL	COASTAL	2		WEAK OR INEFFECTIVE ON PARTICULAR SPECIES	G		N	FREQUENTLY	1	1	
CUTWORMS	INSECTS	CARBARYL	COASTAL	3	ONLY METHOD OR MATERIAL WHICH PROVIDES FOR A SHORT RE-PLANT INTERVAL	WEAK OR INEFFECTIVE ON PARTICULAR SPECIES	G			FREQUENTLY	10	39	
CUTWORMS	INSECTS	CARBARYL	S COAST	2			G		N	ALWAYS	1	1	
CUTWORMS	INSECTS	CARBARYL	SAN JQ	2			G		N	ALWAYS	1	1	
CUTWORMS	INSECTS	CHLOROPICRIN	COASTAL	2		WORKER SAFETY/HANDLING	F		N	ALWAYS	0	1	
CUTWORMS	INSECTS	CHLOROPICRIN	S COAST	2		WORKER SAFETY/HANDLING	F		N	ALWAYS	0	1	
CUTWORMS	INSECTS	CHLOROPICRIN	SAN JQ	2		WORKER SAFETY/HANDLING	F		N	ALWAYS	0	1	
CUTWORMS	INSECTS	CHLORPYRIFOS	COASTAL	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	1	1	
CUTWORMS	INSECTS	CHLORPYRIFOS	S COAST	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	1	1	
CUTWORMS	INSECTS	CHLORPYRIFOS	SAN JQ	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	1	1	
CUTWORMS	INSECTS	DIAZINON	COASTAL	2			G	A	?	FREQUENTLY	5	1	
CUTWORMS	INSECTS	DIAZINON	S COAST	2			G	A	?	FREQUENTLY	5	1	
CUTWORMS	INSECTS	DIAZINON	SAN JQ	2			G	A	?	FREQUENTLY	5	1	
CUTWORMS	INSECTS	METHYL BROMIDE	COASTAL	2		WORKER SAFETY/HANDLING	F		N	ALWAYS	0	1	
CUTWORMS	INSECTS	METHYL BROMIDE	S COAST	2		WORKER SAFETY/HANDLING	F		N	ALWAYS	0	1	
CUTWORMS	INSECTS	METHYL BROMIDE	SAN JQ	2		WORKER SAFETY/HANDLING	F		N	ALWAYS	0	1	
CYCLAMEN MITE	INSECTS	AVERMECTIN	COASTAL	2		MORE EXPENSIVE	G			ALWAYS	1	1	
CYCLAMEN MITE	INSECTS	AVERMECTIN	COASTAL	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G			ALWAYS	1	1	
CYCLAMEN MITE	INSECTS	AVERMECTIN	COASTAL	2		TEMPERATURE AND/OR SEASONAL DEPENDENCE	G			ALWAYS	1	1	
CYCLAMEN MITE	INSECTS	AVERMECTIN	S COAST	2		MORE EXPENSIVE	G			ALWAYS	1	1	
CYCLAMEN MITE	INSECTS	AVERMECTIN	S COAST	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G			ALWAYS	1	1	
CYCLAMEN MITE	INSECTS	AVERMECTIN	S COAST	2		TEMPERATURE AND/OR SEASONAL DEPENDENCE	G			ALWAYS	1	1	
CYCLAMEN MITE	INSECTS	AVERMECTIN	SAN JQ	2		MORE EXPENSIVE	G			ALWAYS	1	1	
CYCLAMEN MITE	INSECTS	AVERMECTIN	SAN JQ	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G			ALWAYS	1	1	
CYCLAMEN MITE	INSECTS	AVERMECTIN	SAN JQ	2		TEMPERATURE AND/OR SEASONAL DEPENDENCE	G			ALWAYS	1	1	
CYCLAMEN MITE	INSECTS	AVOID SECOND YEAR PLANTINGS IN PROBLEM AREAS.	COASTAL	1	OTHER	LOWER YIELD/LOWER GRADE				RARE		39	
CYCLAMEN MITE	INSECTS	AVOID SECOND YEAR PLANTINGS IN PROBLEM AREAS.	COASTAL	2		MORE EXPENSIVE				FREQUENTLY	10	1	
CYCLAMEN MITE	INSECTS	AVOID SECOND YEAR PLANTINGS IN PROBLEM AREAS.	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	10	1	
CYCLAMEN MITE	INSECTS	AVOID SECOND YEAR PLANTINGS IN PROBLEM AREAS.	S COAST	2		MORE EXPENSIVE				FREQUENTLY	10	1	
CYCLAMEN MITE	INSECTS	AVOID SECOND YEAR PLANTINGS IN PROBLEM AREAS.	S COAST	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	10	1	
CYCLAMEN MITE	INSECTS	AVOID SECOND YEAR PLANTINGS IN PROBLEM AREAS.	SAN JQ	1		MORE EXPENSIVE				FREQUENTLY	10	1	
CYCLAMEN MITE	INSECTS	AVOID SECOND YEAR PLANTINGS IN PROBLEM AREAS.	SAN JQ	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	10	1	
CYCLAMEN MITE	INSECTS	DICOFOL	COASTAL	1		POTENTIAL RESISTANCE PROBLEMS	G		Y	ALWAYS	20	1	

Major pests and their methods of control in strawberries in California, from a survey

This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations of the terms is given in the following table. Data is from the 1996 Pest Management Survey Database, which was developed jointly by DPR and the UC Statewide IPM Project. Department of Pesticide Regulation-- April 15, 1998

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Resist	Meet market standards	Yield red.	Survey no	Comments
CYCLAMEN MITE	INSECTS	DICOFOL	COASTAL	3	PESTICIDE-RESISTANT PEST METHOD OR MATERIAL IS NECESSARY TO MANAGE A	LESS/VARIABLE EFFECTIVENESS	G		Y	FREQUENTLY	10	39	
CYCLAMEN MITE	INSECTS	DICOFOL	S COAST	1		POTENTIAL RESISTANCE PROBLEMS	G		Y	ALWAYS	20	1	
CYCLAMEN MITE	INSECTS	DICOFOL	SAN JQ	1		POTENTIAL RESISTANCE PROBLEMS	G		Y	ALWAYS	20	1	
CYCLAMEN MITE	INSECTS	DIP FREEZER TRAYS IN HOT WATER BETWEEN FIELDS.	COASTAL	1	OTHER	LOWER YIELD/LOWER GRADE				RARE		39	
CYCLAMEN MITE	INSECTS	DIP FREEZER TRAYS IN HOT WATER BETWEEN FIELDS.	COASTAL	2		LESS/VARIABLE EFFECTIVENESS				ALWAYS	10	1	
CYCLAMEN MITE	INSECTS	DIP FREEZER TRAYS IN HOT WATER BETWEEN FIELDS.	COASTAL	2		MORE EXPENSIVE				ALWAYS	10	1	
CYCLAMEN MITE	INSECTS	DIP FREEZER TRAYS IN HOT WATER BETWEEN FIELDS.	S COAST	2		LESS/VARIABLE EFFECTIVENESS				ALWAYS	10	1	
CYCLAMEN MITE	INSECTS	DIP FREEZER TRAYS IN HOT WATER BETWEEN FIELDS.	S COAST	2		MORE EXPENSIVE				ALWAYS	10	1	
CYCLAMEN MITE	INSECTS	DIP FREEZER TRAYS IN HOT WATER BETWEEN FIELDS.	SAN JQ	1		LESS/VARIABLE EFFECTIVENESS				ALWAYS	10	1	
CYCLAMEN MITE	INSECTS	DIP FREEZER TRAYS IN HOT WATER BETWEEN FIELDS.	SAN JQ	1		MORE EXPENSIVE				ALWAYS	10	1	
CYCLAMEN MITE	INSECTS	ENDOSULFAN	COASTAL	1		POTENTIAL GROUND WATER CONTAMINATION	G		N	ALWAYS	10	1	
CYCLAMEN MITE	INSECTS	ENDOSULFAN	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		Y	SOMETIMES	10	39	
CYCLAMEN MITE	INSECTS	ENDOSULFAN	S COAST	1		POTENTIAL GROUND WATER CONTAMINATION	G		N	ALWAYS	10	1	
CYCLAMEN MITE	INSECTS	ENDOSULFAN	SAN JQ	1		POTENTIAL GROUND WATER CONTAMINATION	G		N	ALWAYS	5	1	
CYCLAMEN MITE	INSECTS	PROPARGITE	SAN JQ			POTENTIALLY PHYTOTOXIC	G		N	ALWAYS	5	1	
CYCLAMEN MITE	INSECTS	USE CLEAN STOCK.	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				UNKNOWN		1	
CYCLAMEN MITE	INSECTS	USE CLEAN STOCK.	COASTAL	4	OTHER	LOWER YIELD/LOWER GRADE				RARE		39	
CYCLAMEN MITE	INSECTS	USE CLEAN STOCK.	S COAST	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				UNKNOWN		1	
CYCLAMEN MITE	INSECTS	USE CLEAN STOCK.	SAN JQ	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				UNKNOWN		1	
CYCLAMEN MITE	INSECTS	USUALLY NOT EFFECTIVE: TYPHLODROMUS BELLINUS & RETICULATUS.	COASTAL	1	OTHER	LOWER YIELD/LOWER GRADE				RARE		39	
CYCLAMEN MITE	INSECTS	USUALLY NOT EFFECTIVE: TYPHLODROMUS BELLINUS & RETICULATUS.	COASTAL	4								1	
CYCLAMEN MITE	INSECTS	USUALLY NOT EFFECTIVE: TYPHLODROMUS BELLINUS & RETICULATUS.	S COAST	4								1	
CYCLAMEN MITE	INSECTS	USUALLY NOT EFFECTIVE: TYPHLODROMUS BELLINUS & RETICULATUS.	SAN JQ	4								1	
EUROPEAN EARWIG	INSECTS	DESTROY RUBBISH NEAR STRAWBERRY FIELDS.	COASTAL	0								39	
EUROPEAN EARWIG	INSECTS	DESTROY RUBBISH NEAR STRAWBERRY FIELDS.	COASTAL	2		MORE EXPENSIVE				FREQUENTLY	1	1	
EUROPEAN EARWIG	INSECTS	DESTROY RUBBISH NEAR STRAWBERRY FIELDS.	S COAST	2		MORE EXPENSIVE				FREQUENTLY	1	1	
EUROPEAN EARWIG	INSECTS	DESTROY RUBBISH NEAR STRAWBERRY FIELDS.	SAN JQ	1		MORE EXPENSIVE				FREQUENTLY	1	1	
FILAREE	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE							39	
FOLIAR NEMATODE (APHELENCHOIDES FRAGARIAE)	NEMATODES	CERTIFIED PLANTING STOCK.	COASTAL	4	OTHER							39	
FOLIAR NEMATODE (APHELENCHOIDES FRAGARIAE)	NEMATODES	HOT WATER TREATMENT OF PLANTING STOCK.	COASTAL	3	OTHER							39	
FULLER ROSE BEETLE	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
FULLER ROSE BEETLE	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		MORE EXPENSIVE				UNKNOWN	?	1	
FULLER ROSE BEETLE	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
FULLER ROSE BEETLE	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		SIGNIFICANT LABOR REQUIRED				UNKNOWN	?	1	

Major pests and their methods of cr n strawberries in California, from a survey

This table lists c l and non-chemical control methods for the major pests on strawberries in California. Explanation columns is given in the following table. Data is from the 1996 Pest Management Survey Database, which was developed jointly by DPR and the Jewide IPM Project. Department of Pesticide Regulation– April 15, 1998

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 2	Limitations	1st App	2nd App	Re siet	Meet market standards	Yield rel.	Surv ce	Comments
FULLER ROSE BEETLE	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	4 OTHER		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	40	39	
FULLER ROSE BEETLE	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
FULLER ROSE BEETLE	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		MORE EXPENSIVE				UNKNOWN	?	1	
FULLER ROSE BEETLE	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
FULLER ROSE BEETLE	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		SIGNIFICANT LABOR REQUIRED				UNKNOWN	?	1	
GARDEN SYMPHYLAN	INSECTS	CONTINUOS FLOODING FOR THREE WEEKS IN THE SUMMER.	COASTAL	0								39	
GARDEN SYMPHYLAN	INSECTS	CONTINUOS FLOODING FOR THREE WEEKS IN THE SUMMER.	COASTAL	4		ADDITIONAL RESEARCH IS NEEDED				UNKNOWN	?	1	
GARDEN SYMPHYLAN	INSECTS	CONTINUOS FLOODING FOR THREE WEEKS IN THE SUMMER.	S COAST	4		ADDITIONAL RESEARCH IS NEEDED				UNKNOWN	?	1	
GARDEN SYMPHYLAN	INSECTS	CONTINUOS FLOODING FOR THREE WEEKS IN THE SUMMER.	SAN JQ	4		ADDITIONAL RESEARCH IS NEEDED				UNKNOWN	?	1	
GARDEN SYMPHYLAN	INSECTS	DISKING IN A CROP OF SORGHUM.	COASTAL	0								39	
GARDEN SYMPHYLAN	INSECTS	DISKING IN A CROP OF SORGHUM.	COASTAL	4		ADDITIONAL RESEARCH IS NEEDED				UNKNOWN	?	1	
GARDEN SYMPHYLAN	INSECTS	DISKING IN A CROP OF SORGHUM.	S COAST	4		ADDITIONAL RESEARCH IS NEEDED				UNKNOWN	?	1	
GARDEN SYMPHYLAN	INSECTS	DISKING IN A CROP OF SORGHUM.	SAN JQ	4		ADDITIONAL RESEARCH IS NEEDED				UNKNOWN	?	1	
GARDEN TORTRIX	INSECTS	AVOID SECOND YEAR PLANTINGS.	COASTAL	1		MORE EXPENSIVE				FREQUENTLY	1	1	
GARDEN TORTRIX	INSECTS	AVOID SECOND YEAR PLANTINGS.	COASTAL	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	1	1	
GARDEN TORTRIX	INSECTS	AVOID SECOND YEAR PLANTINGS.	S COAST	1		MORE EXPENSIVE				FREQUENTLY	1	1	
GARDEN TORTRIX	INSECTS	AVOID SECOND YEAR PLANTINGS.	S COAST	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	1	1	
GARDEN TORTRIX	INSECTS	AVOID SECOND YEAR PLANTINGS.	SAN JQ	1		MORE EXPENSIVE				ALWAYS	0	1	
GARDEN TORTRIX	INSECTS	AVOID SECOND YEAR PLANTINGS.	SAN JQ	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	0	1	
GARDEN TORTRIX	INSECTS	ELIMINATE WEED HOSTS	COASTAL	0 OTHER		ADDITIONAL RESEARCH IS NEEDED				NEVER	10	39	
GARDEN TORTRIX	INSECTS	HYPOSOTER EXIGUA AND A VIRUS.	COASTAL	0 OTHER		ADDITIONAL RESEARCH IS NEEDED				NEVER	10	39	
GARDEN TORTRIX	INSECTS	REMOVE ACCUMULATED TRASH IN SPRING.	COASTAL	1		SIGNIFICANT LABOR REQUIRED				FREQUENTLY	5	1	
GARDEN TORTRIX	INSECTS	REMOVE ACCUMULATED TRASH IN SPRING.	S COAST	1		SIGNIFICANT LABOR REQUIRED				FREQUENTLY	5	1	
GARDEN TORTRIX	INSECTS	REMOVE ACCUMULATED TRASH IN SPRING.	SAN JQ	1		SIGNIFICANT LABOR REQUIRED				ALWAYS	0	1	
GREEN PEACH APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				SOMETIMES	5	1	
GREEN PEACH APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	5	1	
GREEN PEACH APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	4 OTHER		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	0	39	
GREEN PEACH APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	S COAST	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				SOMETIMES	5	1	
GREEN PEACH APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	S COAST	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	5	1	
GREEN PEACH APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	SAN JQ	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				SOMETIMES	1	1	
GREEN PEACH APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	SAN JQ	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	1	1	
GREEN PEACH APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	0		MORE EXPENSIVE				ALWAYS	?	1	
GREEN PEACH APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	?	1	
GREEN PEACH APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	0								39	
GREEN PEACH APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	S COAST	0		MORE EXPENSIVE				ALWAYS	?	1	
GREEN PEACH APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	S COAST	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	?	1	
GREEN PEACH APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	SAN JQ	0		MORE EXPENSIVE				ALWAYS	?	1	
GREEN PEACH APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	SAN JQ	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	?	1	

Major pests and their methods of control in strawberries in California, from a survey

This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations of columns is given in the following table. Data is from the 1998 Pest Management Survey Database, wh developed jointly by DPR and the U' 'ewide IPM Project. Department of Pesticide Regulation– April 15, 1998

	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Resist	Meet market standards	Yield red.	Surv ee	Comments
HAIRY NIGHTSHADE	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE							39	
IRIS WHITEFLY	INSECTS	FOR SUMMER PLANTED, TOPPING IN SPRING CAN REDUCE OW POPULATIONS.	COASTAL	0		MORE EXPENSIVE				ALWAYS	?	1	
IRIS WHITEFLY	INSECTS	FOR SUMMER PLANTED, TOPPING IN SPRING CAN REDUCE OW POPULATIONS.	S COAST	1		MORE EXPENSIVE				ALWAYS	?	1	
IRIS WHITEFLY	INSECTS	FOR SUMMER PLANTED, TOPPING IN SPRING CAN REDUCE OW POPULATIONS.	SAN JQ	0		MORE EXPENSIVE				ALWAYS	?	1	
IRIS WHITEFLY	INSECTS	MANY PARASITES & PREDATORS.	COASTAL	0		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				UNKNOWN	?	1	
IRIS WHITEFLY	INSECTS	MANY PARASITES & PREDATORS.	S COAST	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				UNKNOWN	?	1	
IRIS WHITEFLY	INSECTS	MANY PARASITES & PREDATORS.	SAN JQ	2		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				UNKNOWN	?	1	
LEATHER ROT (PHYTOPHTTHORA)	PATHOGEN	AVOID FIELDS WITH WET SATURATED CONDITIONS. NO OVERHEAD IRRIGATION	COASTAL	1		ADDITIONAL RESEARCH IS NEEDED				RARE	5	39	
LEATHER ROT (PHYTOPHTTHORA)	PATHOGEN	METALAXYL	COASTAL	3	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST		G		N	ALWAYS		4	
LEATHER ROT (PHYTOPHTTHORA)	PATHOGEN	METALAXYL	S COAST	3	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST		G		N	ALWAYS		4	
LEATHER ROT (PHYTOPHTTHORA)	PATHOGEN	METHYL BROMIDE	COASTAL	4		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	0	4	
LEATHER ROT (PHYTOPHTTHORA)	PATHOGEN	METHYL BROMIDE	S COAST	4		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	0	4	
LEATHER ROT (PHYTOPHTTHORA)	PATHOGEN	PLASTIC MULCHES.	COASTAL	1		ADDITIONAL RESEARCH IS NEEDED				RARE	5	39	
LEATHER ROT (PHYTOPHTTHORA)	PATHOGEN	REMOVE DISEASED FRUIT.	COASTAL	1		ADDITIONAL RESEARCH IS NEEDED				RARE	5	39	
LEATHER ROT (PHYTOPHTTHORA)	PATHOGEN	SELECT FIELDS ISOLATED FROM CONVENTIONAL GROWING AREAS.	COASTAL	0		ADDITIONAL RESEARCH IS NEEDED				RARE	5	39	
LITTLE MALLOW	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE							39	
LYGUS BUG	INSECTS	CHLOROPICRIN	COASTAL	0								39	
LYGUS BUG	INSECTS	CONTROL WEEDS WITHIN AND AROUND THE FIELD.	COASTAL	2		MORE EXPENSIVE				SOMETIMES	20	1	
LYGUS BUG	INSECTS	CONTROL WEEDS WITHIN AND AROUND THE FIELD.	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	20	1	
LYGUS BUG	INSECTS	CONTROL WEEDS WITHIN AND AROUND THE FIELD.	S COAST	1		MORE EXPENSIVE				SOMETIMES	20	1	
LYGUS BUG	INSECTS	CONTROL WEEDS WITHIN AND AROUND THE FIELD.	S COAST	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	20	1	
LYGUS BUG	INSECTS	CONTROL WEEDS WITHIN AND AROUND THE FIELD.	SAN JQ	0		MORE EXPENSIVE				SOMETIMES	20	1	
LYGUS BUG	INSECTS	CONTROL WEEDS WITHIN AND AROUND THE FIELD.	SAN JQ	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	20	1	
LYGUS BUG	INSECTS	DIAZINON	COASTAL	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC	G	A	?	SOMETIMES	20	1	
LYGUS BUG	INSECTS	DIAZINON	COASTAL	1		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G	A	?	SOMETIMES	20	1	
LYGUS BUG	INSECTS	DIAZINON	COASTAL	1		WEAK OR INEFFECTIVE ON PARTICULAR SPECIES	G	A	?	SOMETIMES	20	1	
LYGUS BUG	INSECTS	DIAZINON	SAN JQ	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC	G	A	?	SOMETIMES	20	1	
LYGUS BUG	INSECTS	DIAZINON	SAN JQ	1		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G	A	?	SOMETIMES	20	1	
LYGUS BUG	INSECTS	DIAZINON	SAN JQ	1		WEAK OR INEFFECTIVE ON PARTICULAR SPECIES	G	A	?	SOMETIMES	20	1	
LYGUS BUG	INSECTS	MALATHION	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		Y	SOMETIMES	20	39	
LYGUS BUG	INSECTS	MALATHION	COASTAL	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	SOMETIMES	20	1	
LYGUS BUG	INSECTS	MALATHION	COASTAL	2		SHORT OR NO RESIDUAL	G		Y	SOMETIMES	20	1	
LYGUS BUG	INSECTS	MALATHION	S COAST	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	SOMETIMES	20	1	
LYGUS BUG	INSECTS	MALATHION	S COAST	2		SHORT OR NO RESIDUAL	G		Y	SOMETIMES	20	1	
LYGUS BUG	INSECTS	MALATHION	SAN JQ	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	SOMETIMES	20	1	

Major pests and their methods of control in strawberries in California, from a survey

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Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Resist	Meet market standards	Yield red.	Survey	Comments
LYGUS BUG	INSECTS	MALATHION	SAN JQ	2		SHORT OR NO RESIDUAL	G		Y	SOMETIMES	20	1	
LYGUS BUG	INSECTS	MANY PREDATORS ON THE NYMPHAL STAGE.	COASTAL	1		LESS/VARIABLE EFFECTIVENESS				RARE	20	1	
LYGUS BUG	INSECTS	MANY PREDATORS ON THE NYMPHAL STAGE.	COASTAL	1		LOW THRESHOLD FOR DAMAGE				RARE	20	1	
LYGUS BUG	INSECTS	MANY PREDATORS ON THE NYMPHAL STAGE.	COASTAL	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				RARE	20	1	
LYGUS BUG	INSECTS	MANY PREDATORS ON THE NYMPHAL STAGE.	S COAST	1		LESS/VARIABLE EFFECTIVENESS				FREQUENTLY	20	1	
LYGUS BUG	INSECTS	MANY PREDATORS ON THE NYMPHAL STAGE.	S COAST	1		LOW THRESHOLD FOR DAMAGE				FREQUENTLY	20	1	
LYGUS BUG	INSECTS	MANY PREDATORS ON THE NYMPHAL STAGE.	S COAST	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	20	1	
LYGUS BUG	INSECTS	MANY PREDATORS ON THE NYMPHAL STAGE.	SAN JQ	1		LESS/VARIABLE EFFECTIVENESS				FREQUENTLY	20	1	
LYGUS BUG	INSECTS	MANY PREDATORS ON THE NYMPHAL STAGE.	SAN JQ	1		LOW THRESHOLD FOR DAMAGE				FREQUENTLY	20	1	
LYGUS BUG	INSECTS	MANY PREDATORS ON THE NYMPHAL STAGE.	SAN JQ	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	20	1	
LYGUS BUG	INSECTS	METHOMYL	COASTAL	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	SOMETIMES	10	1	
LYGUS BUG	INSECTS	METHOMYL	COASTAL	3	METHOD OR MATERIAL IS NECESSARY TO MANAGE A PESTICIDE-RESISTANT PEST	REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	SOMETIMES	10	39	
LYGUS BUG	INSECTS	METHOMYL	SAN JQ	1		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	10	1	
LYGUS BUG	INSECTS	METHYL BROMIDE	COASTAL	0								39	
LYGUS BUG	INSECTS	MEVINPHOS	COASTAL	0								39	
LYGUS BUG	INSECTS	MOW OR DISC UNDER COVER CROPS BEFORE THEY FLOWER.	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	20	1	
LYGUS BUG	INSECTS	MOW OR DISC UNDER COVER CROPS BEFORE THEY FLOWER.	COASTAL	2		TEMPERATURE AND/OR SEASONAL DEPENDENCE				SOMETIMES	20	1	
LYGUS BUG	INSECTS	MOW OR DISC UNDER COVER CROPS BEFORE THEY FLOWER.	S COAST	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	20	1	
LYGUS BUG	INSECTS	MOW OR DISC UNDER COVER CROPS BEFORE THEY FLOWER.	S COAST	0		TEMPERATURE AND/OR SEASONAL DEPENDENCE				SOMETIMES	20	1	
LYGUS BUG	INSECTS	MOW OR DISC UNDER COVER CROPS BEFORE THEY FLOWER.	SAN JQ	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	20	1	
LYGUS BUG	INSECTS	MOW OR DISC UNDER COVER CROPS BEFORE THEY FLOWER.	SAN JQ	0		TEMPERATURE AND/OR SEASONAL DEPENDENCE				SOMETIMES	20	1	
LYGUS BUG	INSECTS	NALED	COASTAL	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		?	SOMETIMES	20	1	
LYGUS BUG	INSECTS	NALED	COASTAL	2		WEAK OR INEFFECTIVE ON PARTICULAR SPECIES	G		Y	SOMETIMES	10	39	
LYGUS BUG	INSECTS	NALED	SAN JQ	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		?	FREQUENTLY	10	1	
LYGUS BUG	INSECTS	PETROLEUM DISTILLATES, AROMATIC	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		Y	SOMETIMES	10	39	
LYGUS BUG	INSECTS	PYRETHRINS	COASTAL	0		LESS/VARIABLE EFFECTIVENESS	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	COASTAL	0		LOWER YIELD/LOWER GRADE	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	COASTAL	0		MORE EXPENSIVE	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	COASTAL	0		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	S COAST	0		LESS/VARIABLE EFFECTIVENESS	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	S COAST	0		LOWER YIELD/LOWER GRADE	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	S COAST	0		MORE EXPENSIVE	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	S COAST	0		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	SAN JQ	0		LESS/VARIABLE EFFECTIVENESS	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	SAN JQ	0		LOWER YIELD/LOWER GRADE	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	SAN JQ	0		MORE EXPENSIVE	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	SAN JQ	0		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	SUCTION DEVICES.	COASTAL	1		LESS/VARIABLE EFFECTIVENESS				SOMETIMES	20	1	
LYGUS BUG	INSECTS	SUCTION DEVICES.	COASTAL	1		MORE EXPENSIVE				SOMETIMES	20	1	
LYGUS BUG	INSECTS	SUCTION DEVICES.	COASTAL	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	20	1	
LYGUS BUG	INSECTS	SUCTION DEVICES.	S COAST	0		LESS/VARIABLE EFFECTIVENESS				SOMETIMES	20	1	
LYGUS BUG	INSECTS	SUCTION DEVICES.	S COAST	0		MORE EXPENSIVE				SOMETIMES	20	1	

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Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Re sist	Meet market standards	Yield red.	Svy ee	Comments
LYGUS BUG	INSECTS	SUCTION DEVICES.	S COAST	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	20	1	
LYGUS BUG	INSECTS	SUCTION DEVICES.	SAN JQ	0		LESS/VARIABLE EFFECTIVENESS				SOMETIMES	20	1	
LYGUS BUG	INSECTS	SUCTION DEVICES.	SAN JQ	0		MORE EXPENSIVE				SOMETIMES	20	1	
LYGUS BUG	INSECTS	SUCTION DEVICES.	SAN JQ	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	20	1	
MITES	INSECTS	FENBUTATIN-OXIDE	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		Y	SOMETIMES	10	39	
MITES	INSECTS	PROPARGITE	COASTAL	4		POTENTIALLY PHYTOTOXIC	G		N	ALWAYS	10	39	
MITES	INSECTS	SULFUR	COASTAL	2			G		Y	SOMETIMES	10	39	
ORANGE TORTRIX	INSECTS	CRYOLITE	COASTAL	0								39	
ORANGE TORTRIX	INSECTS	CRYOLITE	COASTAL			LESS/VARIABLE EFFECTIVENESS	G		N	UNKNOWN	5	1	
ORANGE TORTRIX	INSECTS	CRYOLITE	S COAST			LESS/VARIABLE EFFECTIVENESS	G		N	UNKNOWN	1	1	
ORANGE TORTRIX	INSECTS	ELIMINATE WEED HOSTS	COASTAL	0	OTHER	ADDITIONAL RESEARCH IS NEEDED				NEVER	10	39	
ORANGE TORTRIX	INSECTS	HYPOSOTER EXIGUA AND A VIRUS.	COASTAL	0	OTHER	ADDITIONAL RESEARCH IS NEEDED				NEVER	10	39	
PHYTOPHTHORA CROWN ROT	PATHOGEN	CHLOROPICRIN	COASTAL	4			F		N	ALWAYS	0	4	
PHYTOPHTHORA CROWN ROT	PATHOGEN	CHLOROPICRIN	S COAST	4			F		N	ALWAYS	0	4	
PHYTOPHTHORA CROWN ROT	PATHOGEN	METALAXYL	COASTAL	1		ADDITIONAL RESEARCH IS NEEDED	C		?	UNKNOWN	?	39	
PHYTOPHTHORA CROWN ROT	PATHOGEN	METALAXYL	COASTAL	3	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST	BEST IF APPLIED THROUGH DRIP IRRIGATION	G		N	ALWAYS	0	4	
PHYTOPHTHORA CROWN ROT	PATHOGEN	METALAXYL	S COAST	3	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST	BEST IF APPLIED THROUGH DRIP IRRIGATION	G		N	ALWAYS	0	4	
PHYTOPHTHORA CROWN ROT	PATHOGEN	USE CLEAN PLANT STOCK.	COASTAL	4		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	40	39	
PHYTOPHTHORA CROWN ROT	PATHOGEN	USE CULTIVARS SUITABLE FOR LOCAL CONDITIONS.	COASTAL	0								39	
PHYTOPHTHORA CROWN ROT	PATHOGEN	USE RAISED BEDS & DRIP IRRIGATION. GOOD DRAINAGE.	COASTAL	4						ALWAYS	40	39	
POTATO APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	4	OTHER	MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	0	39	
POTATO APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	4								1	
POTATO APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	S COAST	4								1	
POTATO APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	SAN JQ	4								1	
POTATO APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	0								39	
POTATO APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	4								1	
POTATO APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	S COAST	4								1	
POTATO APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	SAN JQ	4								1	
POWDERY MILDEW (SPHAEROTHECA MACULARIS)	PATHOGEN	AMPELOMYCES QUISQUALIS	COASTAL	1						SOMETIMES	10	4	
POWDERY MILDEW (SPHAEROTHECA MACULARIS)	PATHOGEN	AMPELOMYCES QUISQUALIS	COASTAL	2			G	A	N	ALWAYS	0	4	NEW PRODUCT
POWDERY MILDEW (SPHAEROTHECA MACULARIS)	PATHOGEN	AMPELOMYCES QUISQUALIS	S COAST	2			G	A	N	ALWAYS	0	4	NEW PRODUCT
POWDERY MILDEW (SPHAEROTHECA MACULARIS)	PATHOGEN	MYCLOBUTANIL	COASTAL	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G	A	N	ALWAYS	0	4	
POWDERY MILDEW (SPHAEROTHECA MACULARIS)	PATHOGEN	MYCLOBUTANIL	S COAST	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G	A	N	ALWAYS	0	4	
POWDERY MILDEW (SPHAEROTHECA MACULARIS)	PATHOGEN	SULFUR	COASTAL	2	PRODUCT OR METHOD IS CRITICAL TO MAINTAIN A BIOLOGICALLY INTENSIVE IPM PROGRAM	REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	ALWAYS	1	4	
POWDERY MILDEW (SPHAEROTHECA MACULARIS)	PATHOGEN	SULFUR	S COAST	2	PRODUCT OR METHOD IS CRITICAL TO MAINTAIN A BIOLOGICALLY INTENSIVE IPM PROGRAM	REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	ALWAYS	1	4	
RED STEELE (PHYTOPHTHORA FRAGARIAE)	PATHOGEN	METHYL BROMIDE	COASTAL	3	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST		F		N	ALWAYS		4	
RED STEELE (PHYTOPHTHORA FRAGARIAE)	PATHOGEN	METHYL BROMIDE	S COAST	3	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST		F		N	ALWAYS		4	
RHIZOPUS FRUIT ROT (LEAK)	PATHOGEN	FIELD SANITATION.	COASTAL	2	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST	TEMPERATURE AND/OR SEASONAL DEPENDENCE				FREQUENTLY	20	39	

Major pests and their methods of control in strawberries in California, from a survey

This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations of the ratings is given in the following table. Data is from the 1996 Pest Management Survey Database, which was developed jointly by DPR and the UC Statewide IPM Project. Department of Pesticide Regulation-- April 15, 1998

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Resist	Meet market standards	Yield red.	Surv ee	Comments
RHIZOPUS FRUIT ROT (LEAK)	PATHOGEN	HANDLE FRUIT WITH CARE AT ALL TIMES.	COASTAL	4	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST	TEMPERATURE AND/OR SEASONAL DEPENDENCE				FREQUENTLY	20	39	
RHIZOPUS FRUIT ROT (LEAK)	PATHOGEN	USE CULTIVARS WITH THICK CUTICLES.	COASTAL	0								39	
ROOT-KNOT NEMATODES (MELOIDOGYNE)	NEMATODES	CERTIFIED PLANTING STOCK.	COASTAL	4	OTHER							39	
ROOT-KNOT NEMATODES (MELOIDOGYNE)	NEMATODES	HOT WATER TREATMENT OF PLANTING STOCK.	COASTAL	3	OTHER							39	
SALTMARSH CATERPILLAR	INSECTS	A NATURALLY OCCURRING VIRUS & MANY NATURAL ENEMIES.	COASTAL	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				FREQUENTLY	1	1	
SALTMARSH CATERPILLAR	INSECTS	A NATURALLY OCCURRING VIRUS & MANY NATURAL ENEMIES.	COASTAL	1		LESS/VARIABLE EFFECTIVENESS				FREQUENTLY	1	1	
SALTMARSH CATERPILLAR	INSECTS	A NATURALLY OCCURRING VIRUS & MANY NATURAL ENEMIES.	COASTAL									39	? DON'T KNOW
SALTMARSH CATERPILLAR	INSECTS	A NATURALLY OCCURRING VIRUS & MANY NATURAL ENEMIES.	S COAST	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				FREQUENTLY	1	1	
SALTMARSH CATERPILLAR	INSECTS	A NATURALLY OCCURRING VIRUS & MANY NATURAL ENEMIES.	S COAST	1		LESS/VARIABLE EFFECTIVENESS				FREQUENTLY	1	1	
SALTMARSH CATERPILLAR	INSECTS	A NATURALLY OCCURRING VIRUS & MANY NATURAL ENEMIES.	SAN JQ	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				FREQUENTLY	1	1	
SALTMARSH CATERPILLAR	INSECTS	A NATURALLY OCCURRING VIRUS & MANY NATURAL ENEMIES.	SAN JQ	1		LESS/VARIABLE EFFECTIVENESS				FREQUENTLY	1	1	
SALTMARSH CATERPILLAR	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G	?		SOMETIMES	10	39	
SALTMARSH CATERPILLAR	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2			G	N		FREQUENTLY	1	1	
SALTMARSH CATERPILLAR	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	S COAST	2			G	N		ALWAYS	0	1	
SALTMARSH CATERPILLAR	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	SAN JQ	2			G	N		ALWAYS	0	1	
SALTMARSH CATERPILLAR	INSECTS	CRYOLITE	COASTAL	0								39	
SALTMARSH CATERPILLAR	INSECTS	CRYOLITE	COASTAL			LESS/VARIABLE EFFECTIVENESS	G	N		UNKNOWN	1	1	
SALTMARSH CATERPILLAR	INSECTS	CRYOLITE	S COAST			LESS/VARIABLE EFFECTIVENESS	G	N		UNKNOWN	1	1	
SALTMARSH CATERPILLAR	INSECTS	CRYOLITE	SAN JQ			LESS/VARIABLE EFFECTIVENESS	G	N		UNKNOWN	1	1	
SALTMARSH CATERPILLAR	INSECTS	STOP MIGRATION FROM ADJACENT FIELDS WITH PHYSICAL BARRIERS	COASTAL	0								39	
SALTMARSH CATERPILLAR	INSECTS	STOP MIGRATION FROM ADJACENT FIELDS WITH PHYSICAL BARRIERS.	COASTAL	0		LESS/VARIABLE EFFECTIVENESS				ALWAYS	1	1	
SALTMARSH CATERPILLAR	INSECTS	STOP MIGRATION FROM ADJACENT FIELDS WITH PHYSICAL BARRIERS.	COASTAL	0		MORE EXPENSIVE				ALWAYS	1	1	
SALTMARSH CATERPILLAR	INSECTS	STOP MIGRATION FROM ADJACENT FIELDS WITH PHYSICAL BARRIERS.	COASTAL	0		PROBLEMS WITH AVAILABILITY				ALWAYS	1	1	
SALTMARSH CATERPILLAR	INSECTS	STOP MIGRATION FROM ADJACENT FIELDS WITH PHYSICAL BARRIERS.	COASTAL	0		SIGNIFICANT LABOR REQUIRED				ALWAYS	1	1	
SALTMARSH CATERPILLAR	INSECTS	STOP MIGRATION FROM ADJACENT FIELDS WITH PHYSICAL BARRIERS.	S COAST	0		LESS/VARIABLE EFFECTIVENESS				ALWAYS	1	1	
SALTMARSH CATERPILLAR	INSECTS	STOP MIGRATION FROM ADJACENT FIELDS WITH PHYSICAL BARRIERS.	S COAST	0		MORE EXPENSIVE				ALWAYS	1	1	
SALTMARSH CATERPILLAR	INSECTS	STOP MIGRATION FROM ADJACENT FIELDS WITH PHYSICAL BARRIERS.	S COAST	0		PROBLEMS WITH AVAILABILITY				ALWAYS	1	1	
SALTMARSH CATERPILLAR	INSECTS	STOP MIGRATION FROM ADJACENT FIELDS WITH PHYSICAL BARRIERS.	S COAST	0		SIGNIFICANT LABOR REQUIRED				ALWAYS	1	1	
SALTMARSH CATERPILLAR	INSECTS	STOP MIGRATION FROM ADJACENT FIELDS WITH PHYSICAL BARRIERS.	SAN JQ	0		LESS/VARIABLE EFFECTIVENESS				ALWAYS	1	1	
SALTMARSH CATERPILLAR	INSECTS	STOP MIGRATION FROM ADJACENT FIELDS WITH PHYSICAL BARRIERS.	SAN JQ	0		MORE EXPENSIVE				ALWAYS	1	1	
SALTMARSH CATERPILLAR	INSECTS	STOP MIGRATION FROM ADJACENT FIELDS WITH PHYSICAL BARRIERS.	SAN JQ	0		PROBLEMS WITH AVAILABILITY				ALWAYS	1	1	
SALTMARSH CATERPILLAR	INSECTS	STOP MIGRATION FROM ADJACENT FIELDS WITH PHYSICAL BARRIERS.	SAN JQ	0		SIGNIFICANT LABOR REQUIRED				ALWAYS	1	1	
SNAILS	INSECTS	COPPER BARRIERS	COASTAL	0		LESS/VARIABLE EFFECTIVENESS				SOMETIMES	10	1	
SNAILS	INSECTS	COPPER BARRIERS	COASTAL	0		MORE EXPENSIVE				SOMETIMES	10	1	
SNAILS	INSECTS	COPPER BARRIERS	COASTAL	0		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS				SOMETIMES	10	1	
SNAILS	INSECTS	COPPER BARRIERS	S COAST	0		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS				SOMETIMES	10	1	
SNAILS	INSECTS	COPPER BARRIERS	SAN JQ	0		LESS/VARIABLE EFFECTIVENESS				SOMETIMES	10	1	
SNAILS	INSECTS	COPPER BARRIERS	SAN JQ	0		MORE EXPENSIVE				SOMETIMES	10	1	

Major pests and their methods of cor[illegible]n strawberries in California, from a survey

This table lists c[illegible]l and non-chemical control methods for the major pests on strawberries in California. Explanations [illegible]olumns is given in the following table. Data is from the 1996 Pest Management Survey Database, wh[illegible]s developed jointly by DPR and the [illegible]tewide IPM Project. Department of Pesticide Regulation– April 15, 1998

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Re sist	Meet market standards	Yield est.	Surv ey	Comments
SNAILS	INSECTS	COPPER BARRIERS	SAN JQ	0		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS				SOMETIMES	10	1	
SNAILS	INSECTS	METALDEHYDE	COASTAL	3	ONLY PRODUCT REGISTERED FOR THIS HOST-PEST COMBINATION		G		N	FREQUENTLY	1	1	
SNAILS	INSECTS	METALDEHYDE	COASTAL	3	ONLY REGISTERED PRODUCT WHICH ENABLES THE COMMODITY TO MEET MARKET (INCLUDING EXPORT) REQUIREMENTS		G		N	FREQUENTLY	1	1	
SNAILS	INSECTS	METALDEHYDE	COASTAL	4		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	FREQUENTLY	10	39	
SNAILS	INSECTS	METALDEHYDE	S COAST	3	ONLY PRODUCT REGISTERED FOR THIS HOST-PEST COMBINATION		G		N	FREQUENTLY	1	1	
SNAILS	INSECTS	METALDEHYDE	S COAST	3	ONLY REGISTERED PRODUCT WHICH ENABLES THE COMMODITY TO MEET MARKET (INCLUDING EXPORT) REQUIREMENTS		G		N	FREQUENTLY	1	1	
SNAILS	INSECTS	METALDEHYDE	SAN JQ	3	ONLY PRODUCT REGISTERED FOR THIS HOST-PEST COMBINATION		G		N	FREQUENTLY	1	1	
SNAILS	INSECTS	METALDEHYDE	SAN JQ	3	ONLY REGISTERED PRODUCT WHICH ENABLES THE COMMODITY TO MEET MARKET (INCLUDING EXPORT) REQUIREMENTS		G		N	FREQUENTLY	1	1	
STRAWBERRY APHID	INSECTS	DIAZINON	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC	G	A	?	FREQUENTLY	5	1	
STRAWBERRY APHID	INSECTS	DIAZINON	S COAST	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC	G	A	?	FREQUENTLY	5	1	
STRAWBERRY APHID	INSECTS	DIAZINON	SAN JQ	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC	G	A	?	FREQUENTLY	5	1	
STRAWBERRY APHID	INSECTS	MALATHION	COASTAL	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	MALATHION	COASTAL	2		SHORT OR NO RESIDUAL	G		Y	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	MALATHION	S COAST	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	MALATHION	S COAST	2		SHORT OR NO RESIDUAL	G		Y	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	MALATHION	SAN JQ	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	MALATHION	SAN JQ	2		SHORT OR NO RESIDUAL	G		Y	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	NALED	COASTAL	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	NALED	S COAST	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	NALED	SAN JQ	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	COASTAL	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	COASTAL	2		MORE EXPENSIVE	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	COASTAL	2		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	S COAST	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	S COAST	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	S COAST	2		MORE EXPENSIVE	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	S COAST	2		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	SAN JQ	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	SAN JQ	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	SAN JQ	2		MORE EXPENSIVE	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	SAN JQ	2		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				SOMETIMES	5	1	
STRAWBERRY APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	5	1	
STRAWBERRY APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	4	OTHER	MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	0	39	

Major pests and their methods of control in strawberries in California, from a survey

This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations of ' mns is given in the following table. Data is from the 1996 Pest Management Survey Database, whic eveloped jointly by DPR and the UC ide IPM Project. Department of Pesticide Regulation-- April 15, 1996

Pes.	Pest type	AI or Control Method	Region	Rat ing	...xplanation for rating of 3	Limitations	1st App	2nd App	Re elat	Meet market standards	Yield red.	Svy se	Comments
STRAWBERRY APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	S COAST	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				SOMETIMES	5	1	
STRAWBERRY APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	S COAST	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	5	1	
STRAWBERRY APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	SAN JQ	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				SOMETIMES	1	1	
STRAWBERRY APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	SAN JQ	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	1	1	
STRAWBERRY APHID	INSECTS	PYRETHRINS	COASTAL	1		LESS/VARIABLE EFFECTIVENESS	G		N	SOMETIMES	20	1	
STRAWBERRY APHID	INSECTS	PYRETHRINS	COASTAL	1		LOWER YIELD/LOWER GRADE	G		N	SOMETIMES	20	1	
STRAWBERRY APHID	INSECTS	PYRETHRINS	COASTAL	1		MORE EXPENSIVE	G		N	SOMETIMES	20	1	
STRAWBERRY APHID	INSECTS	PYRETHRINS	COASTAL	1		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
STRAWBERRY APHID	INSECTS	PYRETHRINS	S COAST	1		LOWER YIELD/LOWER GRADE	G		N	SOMETIMES	20	1	
STRAWBERRY APHID	INSECTS	PYRETHRINS	S COAST	1		MORE EXPENSIVE	G		N	SOMETIMES	20	1	
STRAWBERRY APHID	INSECTS	PYRETHRINS	S COAST	1		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
STRAWBERRY APHID	INSECTS	PYRETHRINS	SAN JQ	1		LESS/VARIABLE EFFECTIVENESS	G		N	SOMETIMES	20	1	
STRAWBERRY APHID	INSECTS	PYRETHRINS	SAN JQ	1		LOWER YIELD/LOWER GRADE	G		N	SOMETIMES	20	1	
STRAWBERRY APHID	INSECTS	PYRETHRINS	SAN JQ	1		MORE EXPENSIVE	G		N	SOMETIMES	20	1	
STRAWBERRY APHID	INSECTS	PYRETHRINS	SAN JQ	1		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
STRAWBERRY APHID	INSECTS	ROTENONE	SAN JQ	1		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
STRAWBERRY APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	0		MORE EXPENSIVE				ALWAYS	?		1
STRAWBERRY APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	?		1
STRAWBERRY APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	0									39
STRAWBERRY APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	S COAST	0		MORE EXPENSIVE				ALWAYS	?		1
STRAWBERRY APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	S COAST	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	?		1
STRAWBERRY APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	SAN JQ	0		MORE EXPENSIVE				ALWAYS	?		1
STRAWBERRY APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	SAN JQ	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	?		1
STRAWBERRY WHITEFLY	INSECTS	FOR SUMMER PLANTED, TOPPING IN SPRING CAN REDUCE OW POPULATIONS.	COASTAL	0							0	39	
STRAWBERRY WHITEFLY	INSECTS	FOR SUMMER PLANTED, TOPPING IN SPRING CAN REDUCE OW POPULATIONS.	COASTAL	1		MORE EXPENSIVE				FREQUENTLY	?		1
STRAWBERRY WHITEFLY	INSECTS	FOR SUMMER PLANTED, TOPPING IN SPRING CAN REDUCE OW POPULATIONS.	S COAST	1		MORE EXPENSIVE				FREQUENTLY	?		1
STRAWBERRY WHITEFLY	INSECTS	FOR SUMMER PLANTED, TOPPING IN SPRING CAN REDUCE OW POPULATIONS.	SAN JQ	0		MORE EXPENSIVE				ALWAYS	?		1
STRAWBERRY WHITEFLY	INSECTS	MANY PARASITES & PREDATORS.	COASTAL	0							0	39	
STRAWBERRY WHITEFLY	INSECTS	MANY PARASITES & PREDATORS.	COASTAL	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				FREQUENTLY	?		1
STRAWBERRY WHITEFLY	INSECTS	MANY PARASITES & PREDATORS.	S COAST	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				FREQUENTLY	?		1
STRAWBERRY WHITEFLY	INSECTS	MANY PARASITES & PREDATORS.	SAN JQ	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				FREQUENTLY	?		1
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	COASTAL	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	COASTAL	2		MORE EXPENSIVE	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	COASTAL	2		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	S COAST	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	S COAST	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	S COAST	2		MORE EXPENSIVE	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	S COAST	2		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	SAN JQ	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	SAN JQ	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	SAN JQ	2		MORE EXPENSIVE	G		N	FREQUENTLY	10	1	

Major pests and their methods of control in strawberries in California, from a survey

This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations of the ratings is given in the following table. Data is from the 1998 Pest Management Survey Database, which was developed jointly by DPR and the UC Statewide IPM Project. Department of Pesticide Regulation– April 15, 1998

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Resist	Meet market standards	Yield red.	Surv ce	Comments
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	SAN JQ	2		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	AVERMECTIN	COASTAL	2		MORE EXPENSIVE	G			ALWAYS	1	1	
TWOSPOTTED SPIDER MITE	INSECTS	AVERMECTIN	COASTAL	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G			ALWAYS	1	1	
TWOSPOTTED SPIDER MITE	INSECTS	AVERMECTIN	COASTAL	2		TEMPERATURE AND/OR SEASONAL DEPENDENCE	G			ALWAYS	1	1	
TWOSPOTTED SPIDER MITE	INSECTS	AVERMECTIN	S COAST	2		MORE EXPENSIVE	G			ALWAYS	1	1	
TWOSPOTTED SPIDER MITE	INSECTS	AVERMECTIN	S COAST	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G			ALWAYS	1	1	
TWOSPOTTED SPIDER MITE	INSECTS	AVERMECTIN	S COAST	2		TEMPERATURE AND/OR SEASONAL DEPENDENCE	G			ALWAYS	1	1	
TWOSPOTTED SPIDER MITE	INSECTS	AVERMECTIN	SAN JQ	2		MORE EXPENSIVE	G			ALWAYS	1	1	
TWOSPOTTED SPIDER MITE	INSECTS	AVERMECTIN	SAN JQ	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G			ALWAYS	1	1	
TWOSPOTTED SPIDER MITE	INSECTS	AVERMECTIN	SAN JQ	2		TEMPERATURE AND/OR SEASONAL DEPENDENCE	G			ALWAYS	1	1	
TWOSPOTTED SPIDER MITE	INSECTS	FENBUTATIN-OXIDE	COASTAL	2		POTENTIAL RESISTANCE PROBLEMS	G		?	ALWAYS	5	1	
TWOSPOTTED SPIDER MITE	INSECTS	FENBUTATIN-OXIDE	S COAST	2		POTENTIAL RESISTANCE PROBLEMS	G		?	ALWAYS	5	1	
TWOSPOTTED SPIDER MITE	INSECTS	FENBUTATIN-OXIDE	SAN JQ	2		POTENTIAL RESISTANCE PROBLEMS	G		?	ALWAYS	5	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	COASTAL	0		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	COASTAL	0		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	COASTAL	0		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	S COAST	0		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	S COAST	0		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	S COAST	0		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	SAN JQ	0		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	SAN JQ	0		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	SAN JQ	0		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	COASTAL	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	COASTAL	2		MORE EXPENSIVE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	COASTAL	2		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	S COAST	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	S COAST	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	S COAST	2		MORE EXPENSIVE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	S COAST	2		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	SAN JQ	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	SAN JQ	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	SAN JQ	2		MORE EXPENSIVE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	SAN JQ	2		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	COASTAL	0		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	COASTAL	0		LESS/VARIABLE EFFECTIVENESS	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	COASTAL	0		LOWER YIELD/LOWER GRADE	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	COASTAL	0		MORE EXPENSIVE	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	COASTAL	0		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	S COAST	0		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	S COAST	0		LESS/VARIABLE EFFECTIVENESS	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	S COAST	0		LOWER YIELD/LOWER GRADE	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	S COAST	0		MORE EXPENSIVE	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	S COAST	0		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	SAN JQ	0		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	SAN JQ	0		LESS/VARIABLE EFFECTIVENESS	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	SAN JQ	0		LOWER YIELD/LOWER GRADE	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	SAN JQ	0		MORE EXPENSIVE	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	SAN JQ	0		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
VERTICILLIUM WILT	PATHOGEN	CHLOROPICRIN	COASTAL	4			F		N	ALWAYS	0	4	
VERTICILLIUM WILT	PATHOGEN	CHLOROPICRIN	S COAST	4			F		N	ALWAYS	0	4	
VERTICILLIUM WILT	PATHOGEN	METHYL BROMIDE	COASTAL	4		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	0	4	
VERTICILLIUM WILT	PATHOGEN	METHYL BROMIDE	S COAST	4		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	0	4	

Major pests and their methods of cor ...n strawberries in California, from a survey

This table lists c ...l and non-chemical control methods for the major pests on strawberries in California. Explanation ...columns is given in the following table. Data is from the 1996 Pest Management Survey Database, wa... ...developed jointly by DPR and the ...tewide IPM Project. Department of Pesticide Regulation-- April 15, 1996

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Re sist	Meet market standards	Yield red.	Surv ey	Comments
VINEGAR FLIES	INSECTS	GOOD SANITATION IN AND AROUND THE FIELD.	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	1	1	
VINEGAR FLIES	INSECTS	GOOD SANITATION IN AND AROUND THE FIELD.	COASTAL	2		SIGNIFICANT LABOR REQUIRED				FREQUENTLY	1	1	
VINEGAR FLIES	INSECTS	GOOD SANITATION IN AND AROUND THE FIELD.	COASTAL	4 OTHER		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	5	39	
VINEGAR FLIES	INSECTS	GOOD SANITATION IN AND AROUND THE FIELD.	S COAST	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	5	1	
VINEGAR FLIES	INSECTS	GOOD SANITATION IN AND AROUND THE FIELD.	S COAST	2		SIGNIFICANT LABOR REQUIRED				FREQUENTLY	5	1	
VINEGAR FLIES	INSECTS	GOOD SANITATION IN AND AROUND THE FIELD.	SAN JQ	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	0	1	
VINEGAR FLIES	INSECTS	GOOD SANITATION IN AND AROUND THE FIELD.	SAN JQ	2		SIGNIFICANT LABOR REQUIRED				FREQUENTLY	0	1	
VINEGAR FLIES	INSECTS	PYRETHRINS	S COAST	1		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	5	1	
VINEGAR FLIES	INSECTS	PYRETHRINS	S COAST	1		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	5	1	
VINEGAR FLIES	INSECTS	PYRETHRINS	S COAST	1		MORE EXPENSIVE	G		N	FREQUENTLY	5	1	
VINEGAR FLIES	INSECTS	PYRETHRINS	S COAST	1		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	FREQUENTLY	5	1	
VINEGAR FLIES	INSECTS	PYRETHRINS	SAN JQ	1		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	5	1	
VINEGAR FLIES	INSECTS	PYRETHRINS	SAN JQ	1		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	5	1	
VINEGAR FLIES	INSECTS	PYRETHRINS	SAN JQ	1		MORE EXPENSIVE	G		N	FREQUENTLY	5	1	
VINEGAR FLIES	INSECTS	PYRETHRINS	SAN JQ	1		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	FREQUENTLY	5	1	
VINEGAR FLIES	INSECTS	SHORTEN HARVEST INTERVALS AS WEATHER WARMS UP.	COASTAL	1		MORE EXPENSIVE				ALWAYS	0	1	
VINEGAR FLIES	INSECTS	SHORTEN HARVEST INTERVALS AS WEATHER WARMS UP.	COASTAL	1		SIGNIFICANT LABOR REQUIRED				ALWAYS	0	1	
VINEGAR FLIES	INSECTS	SHORTEN HARVEST INTERVALS AS WEATHER WARMS UP.	COASTAL	1		TEMPERATURE AND/OR SEASONAL DEPENDENCE				ALWAYS	0	1	
VINEGAR FLIES	INSECTS	SHORTEN HARVEST INTERVALS AS WEATHER WARMS UP.	COASTAL	4 OTHER		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	0	39	
VINEGAR FLIES	INSECTS	SHORTEN HARVEST INTERVALS AS WEATHER WARMS UP.	S COAST	2		MORE EXPENSIVE				FREQUENTLY	5	1	
VINEGAR FLIES	INSECTS	SHORTEN HARVEST INTERVALS AS WEATHER WARMS UP.	S COAST	2		SIGNIFICANT LABOR REQUIRED				FREQUENTLY	5	1	
VINEGAR FLIES	INSECTS	SHORTEN HARVEST INTERVALS AS WEATHER WARMS UP.	S COAST	2		TEMPERATURE AND/OR SEASONAL DEPENDENCE				FREQUENTLY	5	1	
VINEGAR FLIES	INSECTS	SHORTEN HARVEST INTERVALS AS WEATHER WARMS UP.	SAN JQ	1		MORE EXPENSIVE				ALWAYS	0	1	
VINEGAR FLIES	INSECTS	SHORTEN HARVEST INTERVALS AS WEATHER WARMS UP.	SAN JQ	1		SIGNIFICANT LABOR REQUIRED				ALWAYS	0	1	
VINEGAR FLIES	INSECTS	SHORTEN HARVEST INTERVALS AS WEATHER WARMS UP.	SAN JQ	1		TEMPERATURE AND/OR SEASONAL DEPENDENCE				ALWAYS	0	1	
WEBSPINNING SPIDER MITES	INSECTS	PREDATOR MITE RELEASES	COASTAL	2		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				FREQUENTLY	20	1	
WEBSPINNING SPIDER MITES	INSECTS	PREDATOR MITE RELEASES	COASTAL	2		LOW THRESHOLD FOR DAMAGE				FREQUENTLY	20	1	
WEBSPINNING SPIDER MITES	INSECTS	PREDATOR MITE RELEASES	S COAST	2		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				FREQUENTLY	20	1	
WEBSPINNING SPIDER MITES	INSECTS	PREDATOR MITE RELEASES	S COAST	2		LOW THRESHOLD FOR DAMAGE				FREQUENTLY	20	1	
WEBSPINNING SPIDER MITES	INSECTS	PREDATOR MITE RELEASES	SAN JQ	2		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				FREQUENTLY	20	1	
WEBSPINNING SPIDER MITES	INSECTS	PREDATOR MITE RELEASES	SAN JQ	2		LOW THRESHOLD FOR DAMAGE				FREQUENTLY	20	1	
WEEDS, ALL	PLANT (WEEDS)	DURING GROWTH & AFTER.	COASTAL	0								39	
WEEDS, ALL	PLANT (WEEDS)	METHYL BROMIDE	COASTAL	4		REQUIRES SOIL INCORPORATION	F		N	ALWAYS	20	39	
WEEDS, ALL	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES.	COASTAL	3 NOT APPLICABLE								39	
WEEDS, ALL	PLANT (WEEDS)	ORGANIC MULCHES: WOOD SHAVINGS, CHOPPED STRAW, RICE HULLS.	COASTAL	0								39	
WEEDS, ALL	PLANT (WEEDS)	PREPLANT: SPRINKLER IRRIGATE TO GERMINATE WEEDS.	COASTAL	0								39	
WEEDS, ALL	PLANT (WEEDS)	PREPLANT: TILL WITH MINIMUM SOIL DISTURBANCE.	COASTAL	0								39	
WEEDS, ANNUAL GRASS	PLANT (WEEDS)	METHYL BROMIDE	COASTAL	4		REQUIRES SOIL INCORPORATION	F		N	ALWAYS	10	39	

Major pests and their methods of control in strawberries in California, from a survey

This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations of the columns is given in the following table. Data is from the 1998 Pest Management Survey Database, which was developed jointly by DPR and the UC Statewide IPM Project. Department of Pesticide Regulation– April 15, 1998

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Resist	Meet market standards	Yield red.	Surveyees	Comments
WEEDS, ANNUAL GRASS	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE							39	
WEEDS, PERENNIAL	PLANT (WEEDS)	METHYL BROMIDE	COASTAL	4		REQUIRES SOIL INCORPORATION	F		N	ALWAYS	10	39	
WESTERN FLOWER THRIPS	INSECTS	MINUTE PIRATE BUGS.	COASTAL	2		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				FREQUENTLY	1	1	
WESTERN FLOWER THRIPS	INSECTS	MINUTE PIRATE BUGS.	COASTAL	2		LESS/VARIABLE EFFECTIVENESS				FREQUENTLY	1	1	
WESTERN FLOWER THRIPS	INSECTS	MINUTE PIRATE BUGS.	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	1	1	
WESTERN FLOWER THRIPS	INSECTS	MINUTE PIRATE BUGS.	S COAST	2		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				FREQUENTLY	1	1	
WESTERN FLOWER THRIPS	INSECTS	MINUTE PIRATE BUGS.	S COAST	2		LESS/VARIABLE EFFECTIVENESS				FREQUENTLY	1	1	
WESTERN FLOWER THRIPS	INSECTS	MINUTE PIRATE BUGS.	S COAST	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	1	1	
WESTERN FLOWER THRIPS	INSECTS	MINUTE PIRATE BUGS.	SAN JQ	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				ALWAYS	0	1	
WESTERN FLOWER THRIPS	INSECTS	MINUTE PIRATE BUGS.	SAN JQ	1		LESS/VARIABLE EFFECTIVENESS				ALWAYS	0	1	
WOODSWEEVIL	INSECTS	AVOID SECOND YEAR PLANTINGS	COASTAL	2		MORE EXPENSIVE				FREQUENTLY	?	1	
WOODSWEEVIL	INSECTS	AVOID SECOND YEAR PLANTINGS	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	?	1	
WOODSWEEVIL	INSECTS	AVOID SECOND YEAR PLANTINGS	S COAST	2		MORE EXPENSIVE				FREQUENTLY	?	1	
WOODSWEEVIL	INSECTS	AVOID SECOND YEAR PLANTINGS	S COAST	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	?	1	
WOODSWEEVIL	INSECTS	AVOID SECOND YEAR PLANTINGS	SAN JQ	1		MORE EXPENSIVE				FREQUENTLY	?	1	
WOODSWEEVIL	INSECTS	AVOID SECOND YEAR PLANTINGS	SAN JQ	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	?	1	
WOODSWEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
WOODSWEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		MORE EXPENSIVE				UNKNOWN	?	1	
WOODSWEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
WOODSWEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		SIGNIFICANT LABOR REQUIRED				UNKNOWN	?	1	
WOODSWEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	4	OTHER	MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	40	39	
WOODSWEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
WOODSWEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		MORE EXPENSIVE				UNKNOWN	?	1	
WOODSWEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
WOODSWEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		SIGNIFICANT LABOR REQUIRED				UNKNOWN	?	1	
WOODSWEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
WOODSWEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		MORE EXPENSIVE				UNKNOWN	?	1	
WOODSWEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
WOODSWEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		SIGNIFICANT LABOR REQUIRED				UNKNOWN	?	1	

APPENDIX 3

University of California
Statewide Integrated Pest Management Project

UC Pest Management Guidelines

STRAWBERRY
ANGULAR LEAF SPOT

Pathogen: *Xanthomonas fragariae*
(Reviewed: 08/95, updated: 05/91)

IN THIS GUIDELINE:

SYMPTOMS:
Infection first appears as minute, water-soaked spots [92K] on the lower surface of leaves. The lesions enlarge to form translucent, angular spots that are delineated by small veins and often exude a viscous ooze, which appears as a whitish and scaly film after drying. As the disease progresses, lesions [95K] coalesce and reddish brown spots, which later become necrotic, appear on the upper surface of the leaves. A chlorotic halo usually surrounds the infected area.

COMMENTS ON THE DISEASE:
This bacterium is not free living in soil. It can, however, overwinter in soil on previously infected plant material. Transmission is by splashing water. It is host specific and highly resistant to degradation - it can persist in the soil for long periods of time. It is killed by methyl bromide/chloropicrin mixture used as a preplant fumigant, so it is very likely that most initial infections in fields that have been fumigated originate from contaminated plants. Lesions on the leaf surface serve as a source for secondary inoculum and cells are dispersed by splashing rain or overhead irrigation. The disease is favored by cool, moist days with cold nights near freezing.

Although uncommon in California, Xanthomonas fragariae can cause vascular collapse. This symptom initially appears as a water-soaked area at the base of newly emerged leaves. Shortly after, the whole plant suddenly dies, much like plants infected with crown rot.

COMMENTS ON CONTROL:
Chemical controls are typically ineffective against this pathogen. Copper containing compounds are registered but have caused phytotoxicity with repeated applications. Preplant fumigate with methyl bromide/chloropicrin mixture.

CULTURAL CONTROL:
Use clean planting stock and avoid overhead irrigation when possible.

ORGANICALLY ACCEPTABLE METHODS:
Cultural controls.

WHEN TO TREAT:
Chemical controls are generally not cost effective.

TREATMENT:

Pesticide (commercial name)	Amount/Acre**	P.H.I.+ (days)	Comments
A. FIXED COPPERS#	Label rates		Repeat applications may be phytotoxic to plants.

** Apply all materials in 200 gal water/acre to ensure adequate coverage.
* Permit required from county agricultural commissioner for purchase or use.
+ Preharvest interval. Do not apply within this many days of harvest.

PRECAUTIONS

PUBLICATION:
UC IPM Pest Management Guidelines: Strawberry
D. Gubler
UC DANR Publication 3339

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UC IPM HOME | HELP DESK

University of California
Statewide Integrated Pest Management Project

UC Pest Management Guidelines

STRAWBERRY
ANTHRACNOSE

Pathogen: *Colletotrichum acutatum*
(Reviewed: 08/95, updated: 08/95)

IN THIS GUIDELINE:

SYMPTOMS:
Dark elongated fusiform lesions [63K] appear on petioles and runners, and often girdle the stem. On fruit, light tan to light brown water-soaked lesions [80K] develop and turn into sunken black lesions. Both ripe and unripe fruit can be affected. Wilting or dying plants [72K] infected with Anthracnose crown rot tend to have a red to brown streaking [74K] in the interior of the crown.

COMMENTS ON THE DISEASE:
Warm or cool, wet conditions favor the development of fruit and stem rot. Fungus overwinters in plant debris or alternate weed hosts.

COMMENTS ON CONTROL:
Use protective fungicides such as benomyl or captan. Disease is most common on varieties that fruit in the nursery. Contamination may occur in fruit production fields as a result of nursery infections or contamination of planting material.

CULTURAL CONTROL:
Use drip or furrow irrigation and clean planting stock.

ORGANICALLY ACCEPTABLE CONTROLS:
Cultural controls.

WHEN TO TREAT:
Treat in nurseries when day neutral varieties begin to fruit. Treat in fields before an expected rain.

TREATMENT:

Pesticide (commercial name)	Amount/Acre**	P.H.I.+ (days)	Comments
A. BENOMYL (Benlate)	1 lb		

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...PLUS...
    CAPTAN 50WP          4 lb
    COMMENTS:  Do not apply in combination with, immediately before, or
    closely following oil sprays.

** Apply all materials in 200 gal water/acre to ensure adequate coverage.
 + Preharvest interval.  Do not apply within this many days of harvest.
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PRECAUTIONS

PUBLICATION:
UC IPM Pest Management Guidelines: Strawberry
D. Gubler
UC DANR Publication 3339

TOP OF PAGE | NEW PEST | NEW CROP
UC IPM HOME | HELP DESK